THE AEROPLANE

Incorporating
Aeronautical Engineering
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(1911-1939), C. G. GREY

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CATCHING UP WITH THE FUTURE

AN announcement was made on Monday morning last that in the course of the week the future of the British Aircraft Industry was to be debated in the House of Commons. It may seem strange at first sight that an industry with such a remarkable record of achievement in the export market should be regarded as being in need of political debate. However, the announcement could have been regarded as evidence that at last the realization has spread widely that what you sell today depends on what development you did yesterday and on the research that you have been doing very much earlier than that.

News of the debate, therefore, may reasonably be construed as an indication that the future of national aeronautical research arrangements is at least accepted as a matter for investigation. There is also in some quarters the ever-present suggestion that something remains to be achieved by nationalizing the aircraft industry. It is hardly necessary to comment that we do not expect this suggestion to be made from the Government benches. And in France we can see plenty of evidence that the progress of the industry is to be measured by the extent by which it has departed from nationalization.

Excellence of the recent export figures must be regarded not only as the result of a splendid effort by all concerned in the industry, and not least those who sell aircraft overseas, but also as evidence of the correctness of decisions made by the departments concerned in ordering aircraft for the Services. Consequently there must be concern at the outcome to be expected from the decisions leading to the statements in the now notorious White Paper on Defence that guided missiles are to take the place of manned aircraft. The precipitation with which this conclusion was reached has resulted in the acceptance by this country of Thor guided missiles and though, no doubt, there will be a number of contracts to be placed in this country for ancillary gear, it must mean that a stage in the steady development of military equipment has been eliminated. And, in due course, unless something is done now, that must be reflected in a dip in the export graph.

There are plenty of signs that the Service departments are not convinced that the day of the manned aircraft is over. Indeed the Army in particular is struggling to get the sort of aircraft it needs to move its heavy equipment around an ever-shrinking world in double-quick time. In this connection it is not without significance to recall the progress now being made at Baginton with a private-venture undertaking, the A.W.650. This pressurized aircraft, designed primarily for the civil market, is regarded by many as having a promising future in the military transport field. At the rate at which it is going there seems a good chance of it flying within two years of its inception.

Pictures of the first fuselage appear in this issue and two more are coming up smartly behind it. In all ten sets of parts are in hand in the shops. When one considers that the price of this aeroplane complete with its four Darts will not be so very far short of half a million pounds it is clear that only the resources of a Group like Hawker Siddeleys are able to finance a private venture of such magnitude.

In the light of the celebrations now taking place with regard to the first decade of Silver City car-ferry operations, it is to be noted that this remarkable Armstrong-Whitworth venture has full-width doors at each end of the fuselage. In consequence wheeled loads can be driven out what time wheeled loads are being driven, or pushed, in. This ideal one-way flow arrangement makes possible the halving of turn-round times on car-ferry services, for instance.

Two fields in which private venturing is much more difficult are those of vertical take-off and supersonic flight. One form of vertical take-off capability is receiving some official support though many people feel that nothing like enough effort is being expended on rotary wing aircraft. Another field which is doubly important, for it affects not only the airliner of the future but also military aircraft, and that is the form of vertical take-off which is made possible by the utilization either of vertically disposed lifting turbines or some form lift generated by ducted fan. In this field there is very limited progress. So far there exists only one small experimental flat riser and the first untethered flights of this aircraft have yet to be announced. Yet vertical take-off capability is a must for some types of aircraft.

Meantime there is in existence the committee which has the duty of supervising, or perhaps co-ordinating would be the better word, the efforts of those who are interested in the production of a supersonic airliner. There are plenty of people who do not share our enthusiasm for this project. They feel that the end product will be so expensive both to buy and to operate that the market will be extremely limited. Their argument is that this country with its genius for small-scale production would be better employed turning out the workhorses of the world. But racehorses improve the breed and the thoroughbred supersonic airliner requires an all-out national effort.

MATTERS OF MOMENT

Tea and Sympathy at Coventry

CONDOLENCES are extended to Coventry Corporation, the Royal Aero Club, and all others who had contributed to the careful organization of the National Air Races meeting, that the biggest and last day, Saturday, July 12, should not have had better luck with the weather.

The good weather of the preceding week was not maintained, and early in the day it was apparent that the programme would suffer. Rain fell heavily for most of the time, and it was not until well into the afternoon that an apologetic and tentative sun could be faintly seen. Consequently heavy strain was placed on the refreshment tents affording tea and shelter.

Nevertheless the surprisingly large crowd was not disappointed, and the programme got under way to keep the public enclosures full until the end of the day.

A report of the proceedings is on pages 113-115.

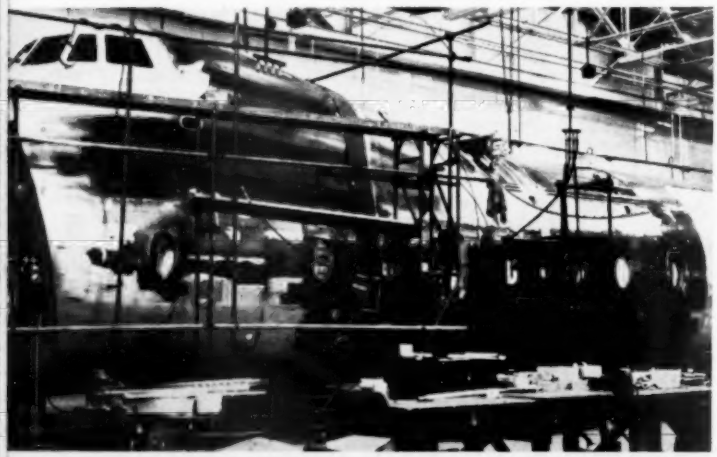
Plans for the N.A.39

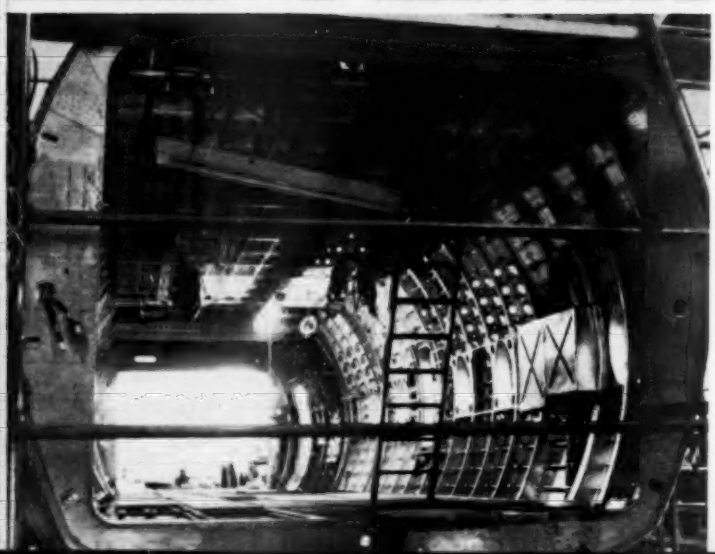
AMERICAN INTEREST in the Blackburn and General Aircraft N.A.39 Naval strike aircraft would appear to have reached a stage at which active discussion of ways and means of exporting the aircraft to the United States is taking place. This was made clear in an answer to a question in the House of Commons last week, when the Minister of Supply, Mr. Aubrey Jones, confirmed that the company had been authorized to seek orders from America. Indeed in a later answer he said categorically that certain negotiations were taking place with a view to a licence agreement.

The Minister did not, however, reveal—nor indeed was he asked—what form any such licence agreement would take. The implication is, however, that the N.A.39 might well be built under licence in the United States.

Photograph copyright "The Aeroplane"

THE WINNERS.—After last week's concentrated air racing meeting at Coventry, H. A. G. Smith (left) emerged as British Air Racing Champion and winner of the Goodyear Trophy, and J. H. Denyer won the King's Cup and the Grosvenor Trophy.





Because of the advanced (and, therefore, Security-bound) nature of the aircraft it was questioned in the House whether selling the N.A.39 abroad was advisable anyway. It was thought, too, that American orders were simply a means of supplementing the likely small domestic order for the aircraft so as to help cover its development cost. The Minister was asked to explain why the R.A.F. had refused to have the N.A.39 and the suggestion was made that if the R.A.F. were to decide in its favour, then maybe it would not need to be sold to the Americans.

Mr. Jones, however, would have none of this. The aircraft, he said, was being developed because of a British Naval need for it. It was in the national interest that it should be exported "either as a complete aircraft built in this country or under licence." The Air Ministry had a requirement for a low-flying bomber and was examining whether or not this requirement was best met by the N.A.39 or by some other aircraft; that examination had not yet been completed.

There was, he said, no question of selling to the Americans merely in order to get a big enough order. However big the domestic order, it was surely in the national interest to enlarge the market to meet a national demand.

Two days later, the Parliamentary and Financial Secretary to the Admiralty was asked in the House of Commons to what extent pre-production orders for the N.A.39 had been placed. In reply Mr. R. Allan revealed that although a development batch of 20 had been ordered in July, 1955, no production order as such had yet been placed. He affirmed the Royal Navy's strong need for the aircraft and gave an assurance that the Naval order was not dependent upon sales of the aircraft in America.

No comments have been forthcoming from Blackburn and General Aircraft on the implications of these questions and answers in the House. It is confirmed, however, that the current visit of Capt. E. D. G. Lewin, one of the company's directors, to America, is a routine trip and not specifically connected with any transatlantic interest in the N.A.39.

It seems, incidentally, that the aircraft has been enjoying some remarkably trouble-free development flying from the R.A.E. aerodrome at Thurleigh, near Bedford, when it made its

ARGOSY PROGRESS.—In production at Coventry is the Armstrong Whitworth A.W.650 Argosy, to be powered by four Rolls-Royce Dart R.Da.7 turboprops.

Photographs copyright "The Aeroplane"

ARMAMENT INSTRUCTION.—Production Hunting Jet Provost Mk. 3s are to be equipped to carry eight 25-lb. practice bombs and four Mk. 5 or 8 rocket projectiles in addition to its two .303-in. machine guns. This development aircraft is seen fitted with four Mk. 5 R.Ps.

first flight and, indeed, in one day it succeeded in making three flights. It was flown back from Thurleigh to Brough on July 9 by Mr. D. Whitehead, the company's test pilot, who treated the company's employees to a brief air display of the aircraft (which they had not before seen in the air) before taking it on to Holme-on-Spalding-Moor where it will now be permanently based. Perhaps this transfer from a large research establishment airfield to a much smaller one so soon after its maiden flight can be taken as a measure of the success of its flight trials.

As a postscript to all this discussion of plans for the N.A.39's future, it might be added that a spokesman for the U.S. Defence Department has since been reported as saying that the U.S. Navy has no plan to buy the aircraft. "Serious consideration" had, however, been given to the question before making this decision.

Battle of Britain Association

FOLLOWING the annual reunions of Battle of Britain aircrew since VE-day, the Battle of Britain Fighter Association came into being on March 27 of this year with the objects of looking after the welfare of members and their dependants, in co-operation with the R.A.F. Benevolent Fund, preserving the memory of fighter aircrew who died in the battle, and generally representing them at appropriate functions. President of the Association is Air Chief Marshal the Lord Dowding; Air Chief Marshal Sir Keith Park is life vice-president, and the Chief of the Air Staff and the A.O.C.-in-C., Fighter Command are *ex-officio* vice-presidents.

A permanent home for the Association has been established at the R.A.F. Reserves Club, London, with whom an amalgamation has been made so that members of the Association can join the club as full or associate members. Any surviving aircrew who have not already been advised of the formation of the Association are requested to contact the R.A.F. Reserves Club, 14 South Street, Park Lane, London, W.1.

Aviators and Instructors

RESPONDING to the toast of "the guests" at the 46th Anniversary Reunion Dinner of the Central Flying School Association at Little Rissington last Friday, July 11, MARSHAL OF THE R.A.F. SIR DERMOT BOYLE began by saying that he was grateful to be invited to join their pleasant company, the company of aviators and instructors. Emphasizing that flying instruction was "more important today than it has even been," and that the flying accident rate was also better today than it has ever been in the Service, the Chief of the Air Staff said that the fact that 100 R.A.F. flying instructors are to train the German Air Force showed the high regard that overseas air forces had for the Service.

This continual improvement in the standard of Service flying, which is a direct reflection of the high instructional standard set, and achieved, by the School was mentioned by AIR CDRE. J. N. H. WHITWORTH, the new Commandant. Saying that the large turn-out for the Dinner showed the affection and loyalty that C.F.S. commands, he recorded that after seeing the C.F.S. Jet Provost aerobatic team at Exeter, Sir Frank Whittle remarked that the School had "one standard of product—the very very best."

The toast to the School was proposed by AIR MARSHAL SIR JOHN E. A. BALDWIN, president of the Association, who is to be succeeded as president by Air Marshal Sir Richard Atcherley, A.O.C.-in-C., Flying Training Command. Another guest at the Dinner was Air Chief Marshal Sir Arthur Longmore, who was one of the original four instructors at Gosport—the first military flying school.

Gliding Championship Statistics

ACCORDING to a final "Bulletin on the World Gliding Championships," just received from Poland, the 61 sailplanes taking part put up 1,955 hr. 11 min. of flying during the contest—or inclusive of the preliminary practice period, 2,898 hr. 55 min. Aero-towed launches by 20 tugs added up to 120 hours, and the average time taken to launch all 61 competitors was 35 minutes.

Total distance flown was 62,403 km. during the contest and 21,048 km. during practice, making altogether 83,451 km. or 51,854 miles, which is more than twice round the Earth. Retrieving teams travelled about 150,000 km. (93,000 miles), and telephone calls to the Leszno headquarters from them and from the pilots added up to 182 hr. Altogether 816 flights were made, but on these many of the pilots landed back at Leszno, especially in the training period.

Meals at the canteen were taken regularly by 680 persons, who will not be surprised to learn that the ample fare provided had a calorific value of 8,200 to 9,650 calories per day.—A.E.S.

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An Anglo-Canadian Appointment

FURTHER emphasis on the importance with which the Hawker Siddeley Group regards its Canadian companies was laid last week by the announcement of the appointment to the Group's board of Mr. Crawford Gordon, Jr., O.B.E., president and general manager of A. V. Roe Canada, Ltd. Mr. Crawford Gordon has long played a distinguished part in Canadian industrial and aeronautical affairs and, in particular, with Sir Roy Dobson has been largely responsible for the remarkable progress and expansion of A. V. Roe Canada. His appointment to the board of directors of the parent body should prove of immense benefit to Anglo-Canadian industrial relations.

Born in 1912, Mr. Crawford Gordon graduated as a Bachelor of Commerce from McGill University, Montreal. He became president and director of the English Electric Company of Canada; executive vice-president of the John Inglis company; and he held executive posts in the associated companies of the Canadian Crocker Wheeler Company, of St. Catharine's, and of Production Castings, Ltd., of New Toronto.

During the War he was loaned to the Department of Munitions and Supply in Ottawa and in 1941 became Director-General of Organisation. He later became Assistant Co-ordinator of Production, and was with the Department of Reconstruction and Supply as Director-General of Industrial Conversion. For this work Mr. Crawford Gordon was appointed an O.B.E. in 1946. From February to October, 1951, he was on loan to the Department of Defence Production as Co-ordinator of Production after which he joined A. V. Roe Canada as its president and general manager.

Silver City Celebrations

LAST week this magazine (motto: ALWAYS AHEAD) recorded in a special anniversary feature that this week Silver City Airways (motto: ALWAYS ACROSS) would celebrate 10 years of faultless ferrying and freighting between England and France.

Apart from the fact that Silver City had, in the cross-channel car ferry idea, what turned out to be a natural winner, which they have made the most of, their success has been due in no small measure to their appreciation and use of good publicity. In this and in the other essentials of running the service, Air Commodore "Taffy" Powell was unsurpassed. He even saw the value of inaugurating the ferry from Lympne on the French Bastille Day "juillet quatorze." So it was on that day, 10 years later, that a party of pressmen attended another nicely organized publicity celebration.

At Ferryfield, Lydd, Silver City's own airport on the Kentish coast, the Mayor of Le Touquet, M. Jules Pouget, named the starboard half of one of their Bristol Superfreighters "Fourteenth of July" and received an inscribed tray made appropriately of silver. Then we flew across to Le Touquet where Mr. Gordon Paine, the Mayor of Lydd, named the port side "Juillet Quatorze." Silver City's other aircraft are all going to be named after cities.

Lunch in the Casino followed and Mr. Eoin Mekie, the lively chairman of Silver City, presented a similar tray to Mr. Paine and M. Pouget said he would like to accept, in advance, an invitation to a similar party in 1978. For the more immediate future the Le Touquet airport building extension would soon be in operation as we could see.

We wished that "Taffy" Powell, now living in the Bahamas on doctors' orders, and the other "founder-member," Bill Franklin, commercial director of Silver City, could have been with us.—WREN

Middle East Re-routeing

AS we went to press with this issue, the troubles in Iraq were causing disruptions of the various air services to and through Baghdad and Basra.

B.O.A.C. ceased last Monday to fly to Baghdad and Basra or over Iraqi territory and had re-routed their services so that passengers were still able to reach other centres in the Middle East. K.L.M.'s and P.A.A.'s Baghdad services were being terminated at Ankara, Turkey. Iraqi Airways' Monday service from Baghdad to London operated normally, leaving the capital at 6 a.m. on schedule. Air France's weekly services from London and Paris to Baghdad and Teheran arrived at Baghdad on Monday morning and was due to return on the same day, but the situation will be reviewed by Air France before next week-end's flight.

A World Record Confirmed

THE Fédération Aéronautique Internationale has now officially confirmed the World's air speed record set up on December 12, 1957, by Maj. Adrian E. Drew, U.S.A.F., in a McDonnell F-101A Voodoo jet fighter. His speed was 1,943.5 k.p.h., which is 1,207.63 m.p.h.

The record was made at Edwards A.F.B., Calif., and the aircraft was powered by two Pratt & Whitney J57 turbojets each of 10,000 lb. thrust.

This record at last replaces that set up on March 10, 1956, by Peter Twiss, who achieved 1,132 m.p.h. in the Fairey F.D.2. Confirmation of the record set by Capt. Walter Irwin, U.S.A.F., in the Lockheed F-104A Starfighter (about 1,404 m.p.h.) on May 15 is still pending.

The Bennett Memoirs

AS the result of the revolt in Iraq, a review, written by the Editor of "Pathfinder," a War-time autobiography by Air Vice-Marshal D. C. T. Bennett, C.B., C.B.E., D.S.O., has been unavoidably held over until next week.

Photograph copyright "The Aeroplane"

BRITISH EQUIPPED.—The *coup d'etat* in Iraq last Monday, naturally brings under consideration the Iraqi Air Force, which has extensively used British aircraft since its inception. In this picture are D.H. Vampires of No. 5 Squadron.

News of Aircraft, Engines and Missiles

HIGH FINANCE.—According to the S.B.A.C., Britain's aircraft industry is at present earning in overseas currency "a fraction less than £5 every second of each hour, day and night"—or £18,000 an hour.

LATER MACHS.—Proposed versions of the Convair F-106 Delta Dart are for a P. & W. J58-powered model to attain Mach 3.0 and a Mach 4.0 version with ramjets.

ARROW COSTS.—Canada's Minister of Defence has said that the Avro Aircraft Arrow has, to date, cost $220m. (about £78.6m.). The best way America could help Canada carry her heavy defence costs, he said, would be to place orders for the Arrow.

RUSSIAN BY-PASS.—A sketch of the principles embodied in the Lulka by-pass engine has been displayed in the Air Museum in Moscow. Guides emphasize that it is meant to show only the principles of the engine, not necessarily its actual design. As shown "in principle" the engine has a single-stage fan on the front end and a single-stage turbine. It appears to have a relatively low by-pass ratio. Guides say the engine has been built, but will not say which aeroplane it is in.

JAPAN'S FIRST.—The successful launching of Japan's first full-scale rocket has been announced in Tokyo. It is a meteorological sounding rocket and attained an altitude of 31 miles.

HIGH ABOVE RUSSIA.—A height of 294 miles was recently attained by a Russian single-stage rocket carrying scientific equipment. Its weight was said to be a ton and a half.

COLEOPTER COLLABORATION.—According to reports, Count Zborowski, well known for his recent developments in France of the Coleopter, has joined the B.M.W. company in Western Germany where he will be in charge of the research department. B.M.W. are reported to have acquired the rights in Count Zborowski's patents and his own, French, company will be closely associated with the German one.

PARIS APPROVAL.—On July 7, C.A.A. approval was given to the Morane-Saulnier M.S. 760 Paris twin-jet executive aeroplane. This is the first C.A.A. approval, the makers claim, for any civil jet aircraft.

JETSTAR CIRCULAR.—In a few minutes less than 18 hours, a Lockheed Jetstar powered by two Bristol Orpheus turbojets, has flown round the U.S.A. Starting from Edwards Air Force Base in California, it stopped to refuel at McChord AFB, Washington, Westover AFB Massachusetts, and McCoy A.F.B., Florida, before returning to Edwards—a distance of 6,748 miles in 14 hr. 50 min. flying time. On board were two pilots, two engineers and Mr. C. L. Johnson, Lockheed vice-president. A 530-Imp.-gal. "glove" tank was carried on each wing.

NEW LIGHTPLANE.—First flight of the four-seat D.140 light aeroplane, built by the Société Aéronautique Normande, was on July 4 at Bernay. A 180-b.h.p. Lycoming engine gives a cruising speed of 140 m.p.h. It is planned to build 100 of the type.

WOOMERA PROGRESS.—Australia's Minister of Supply has said that the joint British and Australian long-range missile tests pending at Woomera would last for at least four or five years. An area of 110,000 sq. miles has been declared a prohibited zone in preparation for the tests; the target area, however, is only 30 miles in diameter.

INERTIAL MACE. — Two, interchangeable, guidance systems are currently being test flown in U.S.A.F. Mace guided missiles. With inertial guidance the Mace is designated TM-76B; with ATRAN (map-matching system developed by Goodyear) guidance the designation is TM-76A.

HUGHES GAR-9.—This is the designation of a new air-to-air missile under development for use from the North American F-108. The latter was recently stated by Lt.-Gen. P. L. Pult to be capable of flying "over extremely long distances at Mach 3 and above."

DYNA-SOAR CONTRACTS.—Design contracts for development of the Dyna-Soar boost-glide orbital bomber have been awarded by the U.S.A.F. to two groups of companies headed by the Boeing Airplane Co. and Martin Co. The name Dyna-Soar is derived from "dynamic soaring"; the vehicle will derive more of its lift from centrifugal force than from aerodynamic loads. The Dyna-Soar vehicle will be used for reconnaissance and strategic bombing.

ANTI-RADAR PAINT. — The U.S.A.F. is reported to have developed aircraft and missile coatings which lessen the chance of radar detection. These are said to be heavy coatings of radar-absorbent materials such as rubber bonded to ceramics and horse-hair impregnated with carbon. Other paints may use chemicals similar to those of photographic emulsions; these, it is claimed, will convert radar-wave energy into chemical energy. Present paints are heavy, liable to flake and crack and have poor resistance to rain and weather.

INFLATABLE FOR TWO.—A new two-seat version of the Goodyear inflatable aircraft was demonstrated in America recently. It is powered by a 65-h.p. McCulloch engine and weighs 814 lb. all up.

Howard Levy photograph

AIRBUS ECONOMICS.—The 126-passenger Armstrong Whitworth A.W.670 Airbus, shown by this model, is estimated to have a direct operating cost of less than 2d. per passenger-mile.

KAMAN CONTRACT.—The U.S. Navy Bureau of Aeronautics has awarded a $1,149,000 contract to the Kaman Aircraft Corpn., Bloomfield, Conn., for further development work on VTOL aircraft.

HILLER CHANGE. — Hiller Helicopters has changed its name to the Hiller Aircraft Corpn. The new name is thought to be more suitable in view of the company's work, which now includes many other aircraft fields in addition to helicopter production.

NEXT WEEK

THE issue of THE AEROPLANE dated July 25 will be an enlarged number dealing with Navigation Aids and Systems.

It will include articles describing the present situation and future trends in air traffic control, navigation aids and flight control systems, as well as an illustrated survey of some of the newer equipment and ideas in these fields.

It will cost the usual 1s. 6d.

U.S. RESEARCH SPENDING.—In the year ending June, 1959, the United States plans to spend £2,210 million on research, development and testing of aircraft and missiles for the Services. Of this total, £1,142 million will be spent on missiles.

THRUXTON SALE.—Thruxton Airfield was sold on July 7. It was sold for £27,600 subject to a tenancy of the Wiltshire School of Flying, Ltd., and an unnamed tenant.

UNITED AIRCRAFT DIVISIONS.—Two new divisions have been formed by the United Aircraft Corpn. Its new missiles and space systems division will be staffed by scientists and engineers who have been working on missile and space projects with Hamilton Standard, Pratt & Whitney Aircraft, Sikorsky and Norden. The Norden Division is being formed following the acquisition of the Norden-Ketay Corpn.; it will design and manufacture electronic systems, instruments and components used in missile and aircraft guidance systems.

Commercial Aviation Affairs

EAGLE INTERIOR.—An idea of the effort being put in by the independent operators is provided by this view of the interior of one of Eagle Airways' Viscount 805s with its unusual decorative panels.

MOSCOW EXTENSION.—Aeroflot is putting in a second paved runway at Vnukovo. It runs N.N.E./S.S.W., and crosses the long-established approximately E.-W. runway now used by Tu-104s. A half-mile of approach lighting has been installed at each end of the E.-W. runway during the past year and GCA/ILS installations for this runway have been made permanent, with specially constructed huts for the operators, replacing the earlier trailers usually seen at Russian airports for housing operators of GCA equipment.

BUTLER VISCOUNT SALE.—Following the recent acquisition of Butler Air Transport by Ansett-A.N.A., and the latter's co-ordinated re-equipment plans, the two Butler Viscounts are being offered for sale. We understand that they will be available, together with five spare Darts, as a lot or individually. Known as V.747s, they were delivered in 1956.

EAGLE SUSPENSION. — The Manchester - Brussels - Frankfurt service, operated by Eagle Airways with Viscounts, has been suspended because of lack of traffic.

ETHIOPIAN AGREEMENT. — On July 7 H.E. Dedjazmatch Zewde Gabré-Selassie, chairman of the board and president of Ethiopian Airlines, signed an air services agreement between the U.K. and Ethiopia. Although air services between Ethiopia and adjoining British territories have been in operation for some years there has not previously been a permanent agreement to govern the extent of these services and the conditions under which they operate.

SABENA TERMINAL.—The new Brussels National Air Station, which came into service on June 29, now houses all the airport services, both passenger and freight, of Sabena. Brussels National is connected by rail with the Sabena air terminus next to the Gare Centrale in Brussels.

EAST AFRICAN MOVE. — East African Airways has completed the move of its operations, engineering and administrative activities to Nairobi Airport (Embakasi). On July 6 all DC-3 departures were from Wilson Aerodrome (previously Nairobi West) and arrivals were made through Nairobi Airport. As from July 7 all services are operating to and from Nairobi Airport.

VANGUARD FREIGHTER. — Payload of the Vickers Vanguard in all-freight form will be about 40,000 lb. (18,144 kg.), with a take-off weight of 150,000 lb.

MORE CARAVELLES. — According to reports last week-end from Paris, Air France have decided to take up their option on 12 S.-A. Caravelles—making 24 in all. The second series for Air France are likely to be developed variants with higher-powered Avon R.A.30s and an improved payload/range performance.

AIR BRIDGE TRAFFIC.—In June, traffic figures for the Channel Air Bridge reached an all-time peak when 2,130 vehicles, 7,300 passengers and 1,168 tons of freight were flown. In the first six months of this year services between Southend and Calais, Ostend and Rotterdam have flown 25% more vehicles and 100% more passengers and freight than in the corresponding period last year. The first Bristol Freighter modified by the company was due to enter service this week.

FRIENDSHIP RETURNED. — The Fokker F-27, which has been on a two months' demonstration tour in Brazil, has returned to Schiphol, Amsterdam. For the Atlantic crossing between Recife and Dakar it carried 450 U.S. gal. in pylon tanks, and additional fuselage tankage of 400 U.S. gal.—taking off with 5,000-lb. overload. The aircraft was demonstrated to the Brazilian Air Force and to VASP, VARIG, REAL, Cruzeiro do Sul and Panair do Brasil. A three-day trip was made to La Paz (13,200 ft. altitude), Bolivia; Lloyd Aereo Boliviano has recently ordered three Friendships.

LOS ANGELES EXTENSION.—Work will start soon on the extension, from 8,500 ft. to 10,000 ft., and other improvements to Runway 25L at Los Angeles International. The extension and new taxiways are due to be completed by November 1.

SABENA HELICOPTERING. — Sabena report that 20,000 people have used the Heliport at the Brussels Universal and International Exhibition since it opened two months ago, including 12,000 on local joy-rides. Movements average 45 a day and on one afternoon a single helicopter made 48 successive flights from the site.

BELFAST INQUIRY.—The public inquiry into the crash of a B.E.A. Viscount at Nutts Corner, Belfast, on October 23, 1957, was held on July 8 and 9. The findings will be published in due course and, when the report is available, will be summarized by THE AEROPLANE.

Levy-Artof Photograph

NAPIER IN U.S.—Work is continuing at PacAero's Santa Monica facilities in connection with the Eland-Napier conversions. Some of the people responsible are seen here. Left to right are Mr. K. Greenly, Napier project manager; Mr. A. J. Penn, chief engineer, Napier Gas Turbine division; and Mr. W. R. Ramsaur, vice-president engineering, Garrett Corpn., (parent company of PacAero).

News About People

E. B. SCHAEFER.—We regret to record the death, on July 9, of Mr. E. B. Schaefer, chief engineer of the aircraft division of Canadair, Ltd. Joining the company in 1949, he was previously with the Boeing Airplane Co., for two years, and from 1940 to 1947 was with the Glenn L. Martin Co. in Baltimore.

S.I.M.A. PRESIDENT. — Mr. Raymond B. Brock, M.B.E., F.R.I.C., B.Sc., has been elected president of the Scientific Instrument Manufacturers' Association of Great Britain.

IRISH APPOINTMENT.—Mr. J. F. O'Dowd, formerly sales promotion superintendent for Aer Lingus and Aerlinte Eireann, has been appointed Boston (U.S.A.) area manager of the two companies. Services between Dublin and Boston will be inaugurated in October and in his new position Mr. O'Dowd will be responsible for the overall development of passenger and freight traffic in the Boston area. He worked for B.O.A.C. before joining Aer Lingus in 1952.

PLESSEY EXECUTIVE. — Mr. Andrew M. Brown, M.A., Ph.D., has been appointed executive director of the Plessey Co., Ltd., as from July 7, with special responsibilities as personnel co-ordinator.

NEW DIRECTOR.—Mr. Andrew Smith, D.S.C., C.A., A.C.W.A., has been appointed managing director of the Walter Kidde Co., Ltd., of Northolt.

HELLERMANN SALES.—Mr. T. J. R. Smith has been appointed sales manager of Hellermann, Ltd., of Crawley, Sussex. He joined the company eight years ago.

JORDAN HIGHLANDER.—A picture taken during the recent demonstration of the Scottish Aviation Twin Pioneer at Amman Airport. The group includes cabinet ministers and local dignitaries. Members of the public were given free flights in the aircraft.

ELECTRONICS DIRECTOR. — Col. A. E. Tyler, O.B.E., has been made a director of W. S. Electronics (Production), Ltd.—a subsidiary of K.G. (Holdings), Ltd.

TRANSPORT COUNCILLOR.—Mr. Basil Smallpeice, managing director of B.O.A.C., has been elected to the council of the Institute of Transport for 1958-59 with effect from October 1.

G.W. APPOINTMENT.—Air Cdre. D. N. Kington-Blair-Oliphant, O.B.E., has been appointed Director of Engineering (Guided Weapons) at the Air Ministry. He has been an armament specialist since 1937 when, after flying with No. 142 (Bomber) Sqn., he took the specialist course at the R.A.F. Air Armament School. He was Command Armament Officer, Bomber Command, from 1951 to 1953, and then held a similar appointment at H.Q., F.E.A.F. Since December, 1955, he has commanded No. 1 Radio School at R.A.F. Locking.

MR. E. VARIAN. — We regret to record the death of Mr. E. Varian, chief stores and supply officer of D. Napier and Son, Ltd.. He joined the company in 1940 and was appointed in 1952 to the post he held when he died.

ROTOL CHANGES.—Lt.-Gen. Sir John Evetts, C.B., C.B.E., M.C., has been elected chairman of Rotol, Ltd., and of British Messier, Ltd., as from July 1. Mr. C. J. Luby is now managing director of these companies as from the same date.

MR. C. E. MURRELL.—We are sorry to record the death of Mr. Cyril E. Murrell, managing director and founder of Aero Pictorial, Ltd., of Redhill, on July 4.

MR. A. H. LEAK.—We regret to record that Mr. Arthur H. Leak died suddenly in Oakland, N.J., on June 5. He was 68. During the First World War he worked on aero-engines in this country, serving later at the R.A.E. and with Armstrong Siddeleys and A.B.C. Motors.

CELLON OCCASION.—Left, Mr. W. J. Shilcock, joint managing director of Cellon, Ltd., receiving from the chairman, Mr. J. Duncan Ferguson, a gold watch in recognition of his 30 years' service. Above, Mr. Ferguson with Mr. H. Lazell, joint managing director, who also received a gold watch on his retirement after 42 years with the company. As his last duty Mr. Lazell presented gold watches to members of Cellon's "30-Year Club."

Military Aviation Affairs

ROYAL PRESENTATION. — At Devonport on July 11 H.M. Queen Elizabeth The Queen Mother presented to H.M.S. "Ark Royal" a ceremonial sash for the drum major of its volunteer band. The Queen Mother, who launched the carrier at Birkenhead in 1950, flew to Exeter Airport and then transferred to a R.N. helicopter and alighted on the "Ark Royal." She was met by the carrier's commanding officer, Capt. F. H. E. Hopkins, D.S.O., D.S.C., R.N.

CARDIFF FLY - PAST. — Twelve Javelins from Nos. 46 and 89 Sqns. and 12 Hunters from Nos. 1 and 54 Sqns., Fighter Command, are to fly over during the closing ceremony of the Sixth Empire and Commonwealth Games at Cardiff at 16.55 hrs. on July 26. The formation is to be led by Sqn. Ldr. H. G. James, A.F.C., D.F.M.

DUTCH VISIT.—The aircraft carrier "Karel Doorman" of the R. Neth. Navy (Capt. H.M.L.F.E. Van Oostrom Sode) arrived at Portsmouth on July 8 and is to make catapult deadload and flying trials. She operates No. 860 Sqn. (Sea Hawks) and Nos. 2 and 4 Sqns. (Avengers). The deadload trials, run with the assistance of the R.N. Flight Deck Machinery Training and Trials Unit, were to begin on July 14. Flying trials, with the co-operation of Admiralty officers, will be made in September.

MIRAGE FOR GERMANY?—It is hoped in France that the West German Federal Government will award a large contract to the Dassault company for the Mirage III fighter. The type was flown recently by Maj. Krupinski, pilot with the mission which has recently visited France.

COMET WORK.—Since the introduction of the D.H. Comet 2 to R.A.F. Transport Command two years ago these aircraft—10 of them—have flown 5½ million miles. Passenger miles total 200 million, and large quantities of freight have been carried to the Far East, Australasia, Cyprus and the Near East. In the recent Cyprus operation seven Comets flew 180,000 miles in nine days. Seventy flights have been made over the Atlantic; 60 over the Pacific.

SERVICE INTEREST. — The C.-in-C. of R.A.F. Transport Command, Air Marshal Sir Andrew McKee, recently had a 1½-hr. demonstration flight in the first of B.O.A.C.'s D.H. Comet 4s (G-APDA) at Hatfield. He is seen here, second from right, with, left to right, Mr. P. G. Lucas, Air Cdre. W. D. J. Michie and Mr. Peter Bugge.

AIR TRANSPORT

No Charity at Home

IN the rapidly developing world of aviation there are certain curious anomalies. New countries are emerging and grasping the opportunities presented by their freedom—and civil aviation is invariably among the first of their industries to "get ahead." Many of these countries have inadequate roads and railways and, to overcome their internal transportation problems, they are able to start off on the right foot without the necessity of scrapping obsolete and uneconomic existing forms of transportation Invariably they set up their own national airline, often with the assistance of other major World operators.

There are, of course, reciprocal reasons for this form of development. As new countries they become signatories to the Convention of ICAO and assume certain responsibilities. These lusty youngsters very often require technical assistance and financial aid which are readily forthcoming from the appropriate international bodies set up for the purpose. The result is that they start off with the very great advantage of possessing modern equipment—which is all very commendable.

The anomaly lies in the fact that funds to provide this modern equipment come through agencies to some extent financed by the British Government, and only when one inspects the airfields in the U.K. is it realized how strange this policy is. International airports in the U.K. have been provided with modern equipment—although some of it is still what can only be described as ex-Government surplus, retained as a legacy from the days of R.A.F. occupation.

Our smaller airports, however, are very inadequately equipped, apart from those airfields actually used by the various aircraft manufacturers for testing purposes. In the U.K. the equipment at these minor airports is very sadly lacking and is mostly out of date. Yet overseas countries such as Burma, Indonesia and the various administrations in Africa all possess equipment of modern design.

This anomaly arises from the lack of interest given to internal aviation in the U.K. by the responsible Government departments and the fact that many of the local airports are either privately or municipally owned, with inadequate financial resources to modernize and keep abreast of the times

This aspect of the inadequacy of facilities available at minor airports in the U.K. is high-lighted by the recent announcement that modern air traffic control desks are going to be installed at seven locations in the Belgian Congo. It is a sad commentary on the state of internal civil aviation in the U.K. that despite the fact that well over 150 of these modern air traffic control desks have been installed all the World over the only installations of this kind in the U.K. are at a few aerodromes operated by aircraft manufacturers.

The New Aerad Guide

SOME time ago International Aeradio, Ltd., devised a new format for their "Flight Guide" and this had had a successful trial period on African coverage. Last week, on July 9, a conference was held by I.A.L. to discuss the development of flight information and chart presentation for modern requirements, and this conference was remarkably well attended by U.K. and overseas airline, Ministry and R.A.F. representatives.

In the past, air route manuals have been provided as loose-leaf books which had to be kept up to date by the insertion of new charts or pages as the information changed. This system suffers from disadvantages; bulky loose-leaf books are inconvenient to handle on a modern flight deck, there is the constant danger that charts may be mislaid, and administrative staff have to be employed to insert corrected pages. The new I.A.L. presentation provides operators with completely reprinted books at frequent intervals, the books themselves being spirally bound so that they open flat.

The principal item on the agenda of last week's meeting was the manner in which the coverage for Europe and the Middle East, with its congestion of airways and aerodromes, could be broken down into a convenient number of manuals. Some 700 approach and landing charts and 16 radio navigation charts are needed to cover this area and a four-manual layout—consisting of the U.K. and Continental seaboard; Scandinavia; south-west Europe; and central Europe and the Middle East—was suggested by I.A.L. as the best that could be devised.

The use of white diagrams on a black background, as a visual aid to pilots engaged in night-landing operations, was also discussed—as well as the desirability of introducing a perspective diagram of approach, threshold and runway lightings for use in conjunction with procedure charts. The intention with these charts is to provide pilots with an accurate illustration of the aerodrome lighting as he sees it from the flight deck when approaching a given runway. Specimens of these new types of charts, based on Runway 28R of L.A.P., were presented to the conference.

DOMESTIC 707.—This new picture of a Boeing 707 at Renton shows the first -120 for American Airlines, who have 30 of this variant on order. Seven for American are now on the final assembly line and they are due to go into service on the non-stop New York-West Coast run before the end of this year.

New Names from A.W.A.

FROM Armstrong Whitworth comes the news that their Dart-powered A.W.650, hitherto known as the Freightercoach, is to be named the Argosy. Thus a famous name in early civil air transport is resuscitated—for the original A.W. Argosy, a biplane with three Jaguar radial engines, was the company's first airliner and made its first flight in 1926.

Announcement of this new name for the 650 was made at a Press conference at Baginton last week when, at the same time, Mr. H. M. Woodhams, the company's managing director, revealed that the short-haul version of the A.W.650—the A.W.670 with a wider fuselage and known as the Air Ferry—would be known as the A.W.671 Airbus in its all-passenger form.

With accommodation for 96 passengers on the lower deck and 30 on the upper deck the Airbus has been described by the managing director of Jersey Airlines as the first serious attempt by any manufacturer to cater for the ultra-short-haul traffic. It is intended specifically for stages of the order of 200 miles and will have a direct operating cost over such distances of less than 2d. per seat-mile.

The A.W.670 Air Ferry is the corresponding short-range vehicle carrier with accommodation for six cars on the lower deck and 30 passengers on the upper deck. The A.W.650 Argosy can carry up to 83 passengers or 12½ tons of freight (or a mixture of both); it will have a range of 2,480 nautical miles with a payload of 9,400 lb.

All three versions in this A.W.650/670 series will be powered by four 2,100 e.h.p. Rolls-Royce Dart R.Da.7s. The prototype 650 Argosy is scheduled to make its first flight before the end of the year. Technical data were given in THE AEROPLANE for July 4, and a detailed account of this aircraft's background and development to date appeared in our issue for May 30.

Inexpensive Direction-finder

A NEW low-priced (selling at between £2,000 and £2,300) VHF cathode-ray direction finder (CR/DF) has been developed by Ekco Electronics, Ltd., for the smaller civil airport requirements. A prototype of the equipment has been installed at Southend Airport for the past 12 months and the first public demonstration was given last week.

Known as the Ekco Type CE 178, the CR/DF operates on any one selected frequency in the 118-132 Mc/s band, although alternative equipment can be supplied covering simultaneous operation on two bands—100-118 Mc/s and 132-156 Mc/s. Incorporating a rotating aerial—as opposed to a static one in the majority of CR/DFs—it presents a constant-length trace for all signals on a 6-in.-dia. display. With a probable instrument error of 0.5°, it has a DF range of about 100 miles for aircraft flying at 10,000 ft. and radiating 5-watt R/T transmissions. The diameter of the cone of indecision is 4,000 ft. at an altitude of 5,000 ft., increasing to a diameter of 16,000 ft. at a height of 20,000 ft.

Computing to Sell

BOEING AIRPLANE CO. started to use electronic computers in the preparation of route histories and flight plans for the 707 about 18 months ago. Since then the use of computers by the market research and operational analysis section of the sales department has grown steadily, and about 60-70 hours of computer time per month are now taken up on route studies alone. When we visited Boeing's Transport Division in Seattle last month, we were told that digital computer programmes by the sales department fall into three categories.

First, there is the compilation and analysis of airline schedules, working from data supplied by the airlines and with regular revisions based on the *Airline Guide*. An IBM 704 computer is used to store this data, which is broken down according to equipment, class and sector distance in domestic and international operations, and provides summaries by seat-mile. The routeing and scheduling of aircraft mathematically is now being developed as an outgrowth of this study.

For their airline route studies Boeing chose to use an IBM 701, since this equipment was well known to the company, was already in use and had available capacity. The computing of a flight plan to meet specific conditions is in itself straightforward enough. (French work in this connection was described in THE AEROPLANE for May 16, and a note on the use of computers by Vickers appeared on June 13.)

The diagram (right) shows the basic pattern of a route study comprising an en route calculation and variable reserve calculations. The chain lines in this diagram indicate the variables, which allow for the introduction of individual airline methods of working and any specified reserves. In order to make an analysis the computer has to be given information on the airports—field length, altitude, temperature, slope and wind—and on the specific aircraft type concerned, relating to permissible weights, fuel capacities and so on.

This is done by means of "route" cards (for the airport information) and "rule" cards (for the aircraft information) covering en route and reserve portions and the method of determining operating cost. It will be appreciated that a large number of cards of both types can be held permanently in store and by combining these as required the performance of any Boeing transport—or any other aircraft type for which adequate data are available—over any route and under any conditions can quickly be studied. An individual route case takes the computer 1-3 minutes to calculate.

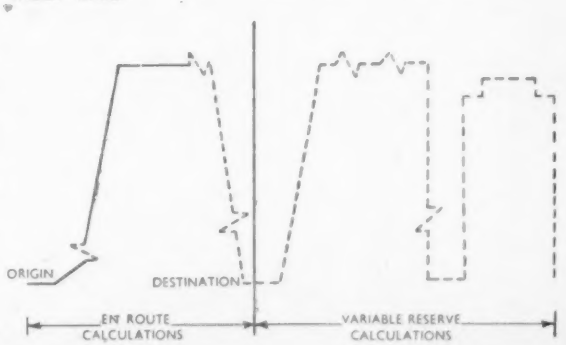
The computer works from the structural limiting weight and runs through the programme laid down. If the end result shows more than the allowable payload, the excess is subtracted and the whole process is repeated, this being continued until the result is within 50 lb. of the permissible limits.

Results are printed by the computer directly on to two sheets specially prepared by Boeing for inclusion in their route analysis reports for specific airlines. The first of these sheets records route, distance, en route winds, payload, fuel burned, block time, reserve fuel, alternate or hold time, "reliability-season," total direct operating cost, cruise procedure, and cost per aircraft-mile and per seat-mile. On the second sheet information is given on the take-off field length required, landing field length available, allowable landing weight, actual landing weight, landing field length required, average number of passengers and block speed.

For Boeing's own purposes, the computer can be made to show, in any particular case, the maximum take-off weight which would be required to carry the maximum payload and the field length required for maximum payload operation, even if this is more than is available.

As an outgrowth of the route study programmes, Boeing have recently embarked on some investigations concerned with "probability of occurrence." These are designed to make possible realistic scheduling at any desired regularity over any given route by taking into account the known variables such as en route winds and temperatures, take-off airport temperatures and required reserves, together with the variable airline requirements, and tabulating the resultant data against the probability of occurrence. It then becomes possible to say, for instance, with what regularity any given load factor could be carried at any time of the year.

To consider one fixed cruise procedure on one route against all the variables, an IBM 704 has to look at 945 cases, which takes about 90 seconds. In a recent "probability of occurrence" study, conducted by Boeing for American Airlines operations, about two million "paper" jet flights were made—a measure of the usefulness of the computer in this kind of work.—F.G.S.



The basic pattern of a route study by computer.

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THE FIGHTING SERVICES

Middle East Air Force

AIR VICE-MARSHAL W. M. L. MACDONALD, C.B., C.B.E., D.F.C., has been appointed Commander-in-Chief, Middle East Air Force, with effect from December, 1958, with the acting rank of Air Marshal. Succeeding Air Marshal Sir Hubert L. Patch, K.C.B., C.B.E., Air Vice-Marshal MacDonald has been Assistant Chief of the Air Staff (Intelligence) since September, 1954, and previously was A.O.C., Singapore, for two years.

Senior R.C.A.F. Postings

THREE changes in senior R.C.A.F. appointments have been announced by the Canadian Minister of Defence. Air Vice-Marshal L. E. Wray, O.B.E., A.F.C., A.O.C., Air Defence Command, since January, 1955, has been appointed A.O.C. No. 1 R.C.A.F. Air Division in Europe. Taking up his new post in September, he will succeed Air Vice-Marshal H. Godwin, C.B.E., who is retiring from the Service.

The present Chief of Operations at R.C.A.F. Headquarters, Air Cdre. W. R. MacBrien, O.B.E., is to become A.O.C., Air Defence Command, in August with the rank of Air Vice-Marshal. Holding his present post since July, 1956, Air Cdre. MacBrien previously served with the 4th A.T.A.F. in Germany.

Director of Canadian Naval Aviation

COMMANDER J. B. FOTHERINGHAM, R.C.N., has been appointed Director of Canadian Naval Aviation at Naval Headquarters in Ottawa. Commander (Air) in H.M.C.S. "Bonaventure" since the carrier was commissioned in January, 1957, Cdr. Fotheringham succeeds Cdr. V. J. Wilgress, R.C.N., who becomes Director of Surface and Air Warfare. In 1955 Cdr. Fotheringham attended a six-month course at the R.A.F. Flying College, Manby.

No. 263 Squadron Disbandment

AS recorded in THE AEROPLANE last week, No. 263 Squadron disbanded on July 1 and re-formed as No. 1 Squadron the following day. Because of commitments it was not possible to hold a ceremony to mark this occasion on the actual day of disbandment, but it is hoped to arrange a No. 263 Squadron reunion soon and ex-members will be informed of details through these columns. Ex-members are reminded that Squadron ties and badges can still be obtained by writing to the Adjutant, No. 1 Squadron, R.A.F. Stradishall, nr. Newmarket, Suffolk.

R,A.F. Escaping Trophy

FLIGHT LIEUTENANT K. HENDERSON, now adjutant of the Flying Wing Headquarters, R.A.F. Wildenrath, 2nd T.A.F., after flying as a navigator there with No. 88 Squadron since 1956, has been chosen as the first winner of the R.A.F. Escaping Society Trophy presented by Col. J. D. Sherwood, Deputy Lieutenant of Essex. The trophy is to be awarded annually for the best individual feat of combat survival undertaken during operations or training.

The trophy will be presented to Flt. Lt. Henderson by Air Chief Marshal Sir Ronald Ivelaw-Chapman, chairman of the R.A.F. Escaping Society, at the Air Ministry on July 29. After great difficulty in separating them, the committee of judges chose Flt. Lt. G. M. Haslop, who was with the British Trans-Antarctic Expedition, and Wg. Cdr. R. W. Leggett, as runners-up to Flt. Lt. Henderson.

Five Maintenance Units Closing

AS part of the contraction and reorganization of the R.A.F., five Aircraft Storage Units are to be closed. All of these units have short runways which are either inextensible, or could only be extended at a prohibitive cost.

It is expected that No. 47 M.U., Hawarden, will be closed by March 31, 1959, and No. 10 M.U., Hullavington, by the end of December, 1959. No. 12 M.U. at Kirkbride, No. 22 M.U., Silloth, and No. 20 M.U., Aston Down, are to be closed down during 1960.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Group Captains: W. G. Morgan, O.B.E., to Air Ministry for duty in the Department of the Air Member for Personnel; E. J. Smith to Air Ministry for duty in the Department of the Air Member for Supply and Organization; W. N. Hibbert to A.F.C.E., for staff duties; P. H. Roscoe to Headquarters, M.E.A.F., for administrative staff duties.

Wing Commanders: R. J. Dempsey, D.F.C., A.F.C., to R.A.F. Northolt as officer in charge of administration; T. Phillips to Air Ministry for duty in the Department of the Air Member for Personnel; J. Seldon, O.B.E., to R.A.F. Wartling as Master Controller; J. O. Gale to the R.A.F. Staff College, Bracknell, for directing staff duties (with acting rank of Gp. Capt.).

Wing Officer: J. A. Bannantyne, W.R.A.F., to Headquarters, Technical Training Command, for administrative staff duties (with acting rank of Gp. Off.).

Wing Commanders: C. F. Babbage, D.F.M., to R.A.F. West Drayton to command and as U.S.A.F. liaison officer; R. Broadbent, D.F.C., to R.A.F. Wittering as Officer Commanding, Flying Wing; J. R. Gibbons, A.F.C., to R.A.F. Bruggen as Officer Commanding Flying Wing; H. M. S. Green to Headquarters, No. 18 Group, for air staff duties; P. L. Hancox, O.B.E., to Air Matériel Command, U.S.A.F., for exchange duties; H. A. Jenkins, D.F.C., to the R.A.F. Staff College, Bracknell, for directing staff duties; G. B. Johns, D.S.O., D.F.C., A.F.C., to Air Ministry for duty in the Department of the Chief of the Air Staff. R. V. Moxey to Headquarters, Maintenance Command, for technical staff Duties; S. A. E. Munns, D.F.M., to Air Ministry for duty in the Department of the C.A.S.; M. E. Pulvermacher to R.A.F. Pergamos, Cyprus, to Command; P. H. Reason to the British Joint Services Mission, Washington; H. K. Rees to R.A.F. Marham as officer commanding the Administrative Wing; D. H. Sutton to R.A.F. Aldergrove as officer commanding, Flying Wing.

Squadron Leaders: E. G. Alcock, A.F.C., to Air Ministry for duty in the Department of the C.A.S. (with acting rank of Wg. Cdr.); L. V. Craxton to Headquarters, Transport Command, for transport support staff duties (with acting rank of Wg. Cdr.); L. G. Goodey, D.F.C., to R.A.F. Watton for technical duties (with acting rank of Wg. Cdr.); R. S. Kerby to the R.A.F. College, Cranwell, as Cadet Wing Administrative Officer (with acting rank of Wg. Cdr.); E. M. Sparrow, D.F.C., to the R.A.F. Flying College, Manby, as Syndicate Leader (with acting rank of Wg. Cdr.); R. H. Benwell to Headquarters, 2nd T.A.F., for German Air Force training duties (with acting rank of Wg. Cdr.); R. F. Hitchcock, A.F.C., to Headquarters, No. 90 Group, as S.P.S.O. (with acting rank of Wg. Cdr.); A. Y. Mason, A.F.C., to Headquarters, No. 12 Group, for operations (control and reporting) duties (with acting rank of Wg. Cdr.); A. R. Scott, D.F.C., to Air Ministry for duty in the Department of the C.A.S. (with acting rank of Wg. Cdr.).

HARMONY AT VALLEY. Queen Elizabeth The Queen Mother paid an informal visit to R.A.F. Valley on July 8 and inspected the new officers' mess. This building, reputed to be the biggest in Anglesey, is also one of the largest R.A.F. messes in the United Kingdom. It is built of steel and concrete, U-shaped and of three storeys, and contains 150 single bed-sitting rooms and some suites for senior officers. This picture shows the dignified yet comfortable appointment of the main anteroom, which overlooks Llyn Penrhyn.

THE VISCOUNT'S TENTH ANNIVERSARY

Ten years ago the Vickers Viscount made its first flight. Hereafter we set out the early history of Britain's most successful post-War airliner ; detail its development ; and describe and illustrate the Viscount 812, recently introduced by Continental Airlines.

The Formative Years

TEN years after the prototype's first flight the Vickers Viscount is today the most successful of Britain's post-War airliners and the most widely used turboprop transport in the World. Nearly 400 have been ordered, of which about 300 are in service, and to date about 1¼ million hours have been flown by this type. Viscounts are now flying some 650,000 hours a year, and this figure is steadily increasing.

The anniversary celebrated two days ago recalled the Viscount's first flight on July 16, 1948, but any account of the aircraft's origins must go back several more years, to the end of 1944 or earlier. Stimulated by the first report of the Brabazon Committee in 1943, the Vickers project design team (in common with designers at other companies throughout the country) had been turning their thoughts towards transport aeroplanes for post-War use.

Projects considered at Weybridge in 1943 and 1944 included, for instance, transport versions of the Wellington and Warwick; 24-seat and 40-seat designs based on the bigger Windsor, for Empire and continental routes respectively; and some entirely original projects, such as a 54-seat transport with four Bristol Centaurus and a 40-passenger design with six Halford H.1 turbojets in the wing or the fuselage.

Many of these projects came to nought, but the Wellington transport studies led in due course to the V.C.1 Viking (Vickers Type 491), a stop-gap short-haul transport which went into service on September 1, 1946. Although not directly related to the Viscount, the Viking played a significant part in the story, for it gave Vickers invaluable early experience of selling commercial aeroplanes, both at home and overseas, and laid the foundations of the B.E.A.-Vickers partnership which, after a false start, was to contribute in such large measure to the Viscount's success. Through the Viking, Vickers were one of the first British manufacturers to turn their attention to commercial aircraft at the end of the War, with the important result that the company was able to keep in close touch with the deliberations and recommendations of the Second Brabazon Committee of 1944-45.

At just what point a turbine-engined successor for the Viking was suggested, or by whom, is not now clear, but this possibility was certainly discussed at a meeting of the Second Brabazon Committee on December 20, 1944, with Rex K. Pierson in attendance. Pierson was at this time chief designer of Vickers-Armstrongs Aircraft Division, the senior members of his project team including F. L. Richards and E. D. Hicks, project engineers; D. L. Ellis, chief aerodynamicist; and Arnold Wright, performance engineer.

At the end of 1944 this team began to investigate a replacement for the Viking in the short-haul field and quickly concluded that the turboprop was considerably more promising than the turbojet which was first considered. Independently, the Brabazon Committee reached the same conclusion, and the idea of a 24-seat turboprop transport for European and other short-to-medium range services began to crystallize. This was to become the Brabazon IIB requirement, the Brabazon IIA being a generally similar piston-engined aircraft.

By March, 1945, general agreement had been reached on the need for such an aeroplane; Lord Brabazon had written to the Minister of Civil Aviation (Lord Swinton) recommending immediate action to start development; and Pierson and his team had brought their studies to the point where a brochure could be submitted to the M.A.P. From the start of the Brabazon IIB type, therefore, the design was very largely associated with Vickers-Armstrongs and with Rex Pierson.

The project designs were studied under the Type 453 designation,* which also covered most of the earlier transport projects in addition to military proposals in 1944. As submitted to the M.A.P. in March, 1945, the proposal was known as the V.C.2 and was set out in three forms. These were a 24-passenger pressurized or non-pressurized type of 35,000 lb. and a slightly larger 27-passenger non-pressurized version, all having a still-air no-reserve range of 1,000 st. miles.

During April, 1945, it was agreed by the M.A.P. and the M.C.A. that Vickers

POWER-PLANE PARTNERSHIP.—Mr. J. D. Pearson, deputy chairman and chief executive, managing director Aero Engine Division, Rolls-Royce Ltd., and Sir George Edwards, managing director Vickers-Armstrongs (Aircraft) Ltd.

* Identification numbers for Vickers aeroplanes are not so much Type numbers as drawing reference numbers. Certain numbers are reserved from time to time for Project Office drawings and thus cover a wide variety of types. If produced, these types are allocated an individual drawing number. The original design studies which led to the Viscount were on Project Office Type 453, and some later work was covered by Type 655. The V.C. numbers distinguish the post-War Vickers Commercial types.

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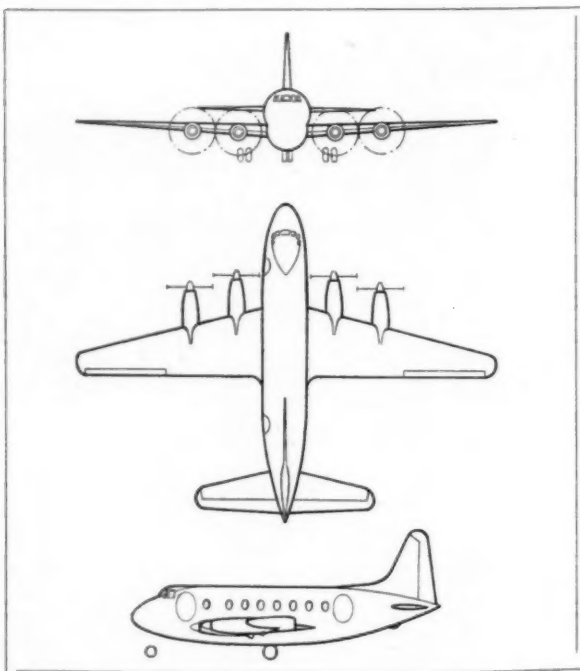
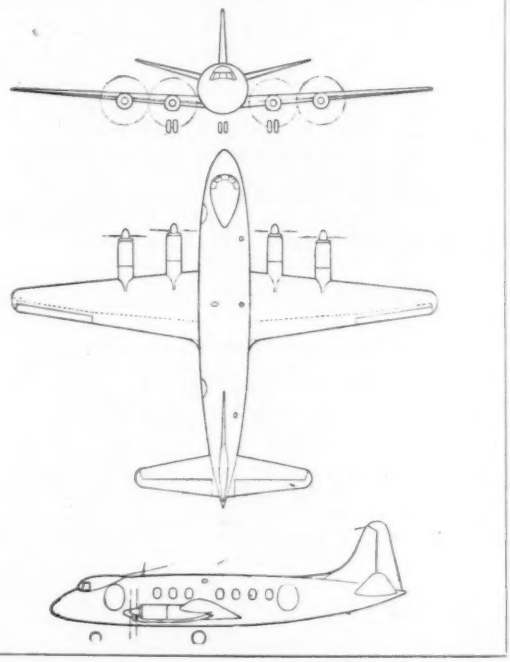
should be encouraged to develop the V.C.2 to meet the Brabazon IIB requirements, which were set out in May. They specified a 24-seat, pressurized, four-engined aeroplane able to carry a 7,500-lb. payload for 900 naut. miles. Vickers responded to this with a firm proposal in June, 1945, the aeroplane at this stage having a "double-bubble" fuselage cross-section and a slightly swept-back wing with straight trailing edge. The large, elliptical windows and the shape of the nose and cockpit, characteristic of the Viscount today, were already features of the proposal at this stage.

No preference had been stated officially for a particular engine and Vickers were at this stage keeping an open mind. There were, in fact, four types of engine prospectively available —the Rolls-Royce Dart, Armstrong Siddeley Mamba, Napier Naiad and Fedden Cotswold—all but the Dart having axial

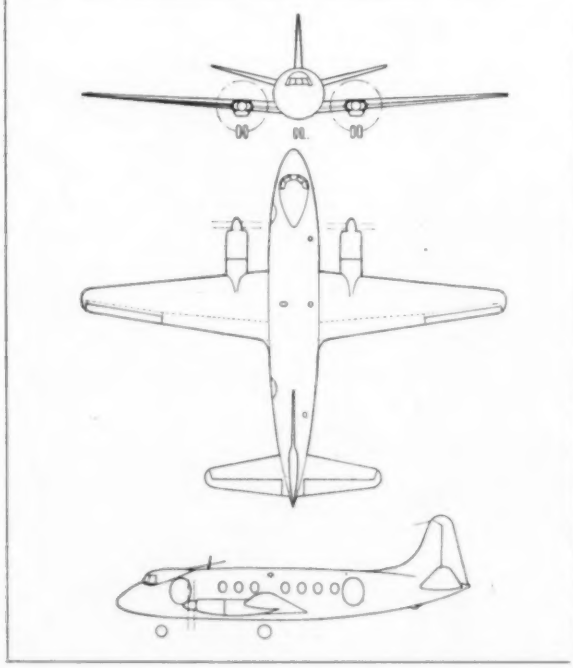
(Continued on page 93)

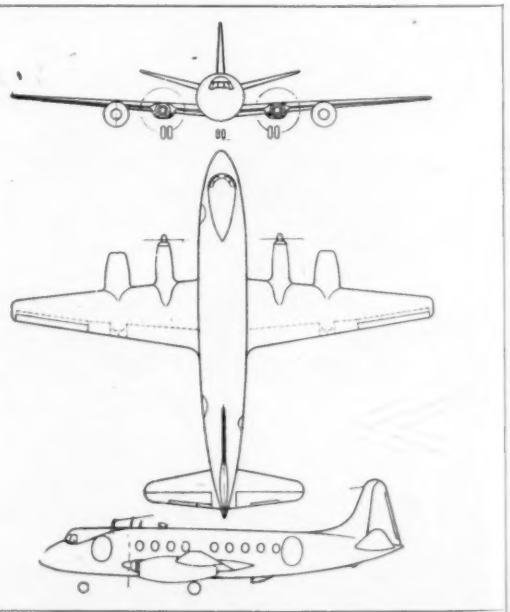




Above, left, one of the earliest of the V.C.2 projects, dated June, 1945, had a double-bubble fuselage and a different wing plan-form, but was to be powered with four Darts.

Above is the V.C.2 as visualized at mid-1946 with four Darts and more or less in the form in which it was built as the V.630.





Above and right are two variants which received passing attention—one (above) with two Napier E.128D Double Naiads and the other, interestingly enough, with Darts inboard and Nene or Derwent turbojets outboard.

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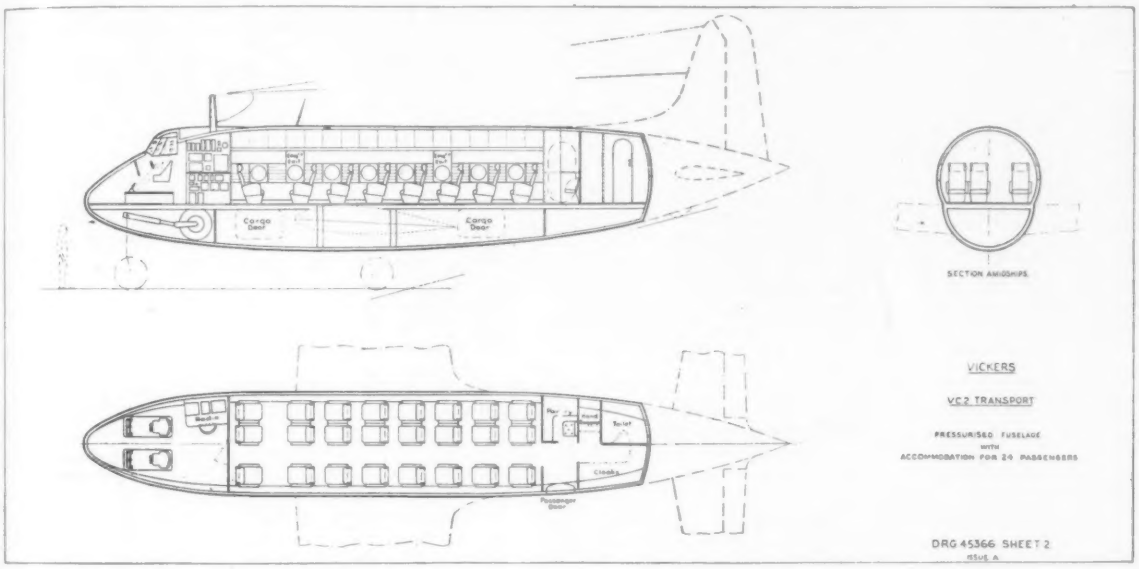

This layout, reproduced from a brochure dated June, 1945, shows one of the earliest V.C.2 schemes. Points of interest are the double-bubble fuselage, the small capacity and the Viking-type tail unit.

(*Continued from page* 92)

compressors. On paper the Cotswold looked promising and was favoured by Pierson, who had had a long and cordial acquaintance with Sir Roy Fedden while he was with the Bristol Aeroplane Co. The great majority of Pierson's aircraft were powered, in fact, by Fedden engines. Its early promise was not maintained, however, and the Cotswold was out of the running before the end of 1945; the Naiad was considered as an alternative for another two years or so, but this also came on so slowly that it was eventually eliminated.

For the remainder of 1945, while negotiations continued with the Ministries and the views of the operators were obtained, Vickers steadily developed the V.C.2 design. The need for pressurization having been established early in the year, the fuselage cross-section was next studied and the double-bubble was abandoned in favour of a circular cross-section without underfloor holds. For the original inwards-retracting undercarriage, with fuselage stowage, was substituted forward retraction into the inboard nacelles. The tailplane was given dihedral and the wing was redesigned to have equal taper on leading and trailing edges.

Information on a suitable wing section was sought from the N.P.L., where, as a result, E. J. Richards first came into contact with the V.C.2 project. Shortly thereafter he joined the Vickers team, succeeding D. L. Ellis as chief aerodynamicist. In September, 1945, Rex Pierson became chief engineer and was succeeded as chief designer by George (now Sir George) Edwards, who had come to Vickers as a draughtsman in 1935 and was at this time, as he had been for the key years of the War, experimental manager.

One of Edwards' first actions was to select an engine for the V.C.2. He chose the Dart—at a time when early test results looked none too good—for the rugged reliability of its centrifugal compressor and the reputation of the firm which made it. This was an act of faith based on shrewd engineering judgment, and one which encouraged Rolls-Royce to redouble their efforts to overcome the early development snags.

By the end of 1945, with George Edwards now in charge of all actual design work on the project, the V.C.2 had become a firm proposal, close in appearance to the form in which the first prototype Viscount flew two years later. In a brochure dated December, 1945, the V.C.2 with four Darts rated at 1,000 s.h.p. and 330-lb. jet thrust, appeared as a 35,500-lb. aeroplane for 24-28 passengers. It had a span of 88 ft., length of 85 ft. 5 in., and gross wing area of 860 sq. ft. With no allowances, the 7,500-lb. payload could be carried over 900 naut. miles at 256 knots at 20,000 ft. and the max. range was 1,200 naut. miles.

The cabin layout was interesting as it illustrated the tendency, in those early post-War years, to underestimate required capacity. Twenty-four passengers were to be carried in pairs of seats at 40-in. pitch, and all the luggage and freight holds (with the exception of a small diplomatic mail compartment) were on the main cabin floor. An investigation of operating costs estimated that these would be a fraction under 6d. per capacity ton-mile for the 24-seat aeroplane at 20,000 ft. over 400-700 miles (with 350-mile diversion reserve) in still air, assuming 3,000-hour annual utilization.

This proposal formed the basis on which the V.C.2 was eventually ordered by the Ministry of Supply (which had taken over from the M.A.P.), the first contract with Vickers being dated March 9, 1946. It had at first been proposed to order four prototypes, but this was reduced to two, it being agreed that Vickers should themselves finance a third. The M.o.S. Specification (8/46), issued to cover the contract, followed the Vickers proposal closely, but asked for provision for up to 32 passengers. This led to a further fuselage stretch to 74.5 ft. and the span was increased to 89 ft.

Because the Mamba was now making better progress than the Dart, the M.o.S. asked for these engines to be used in their two prototypes—although Vickers still favoured the Dart and remained uncommitted. With Mambas and the new fuselage the weight went up to 38,170 lb. and then to 39,500 lb. Having passed at last out of the project stage, the V.C.2 now took on a new Vickers Type number—V.609—and the name Viceroy became associated with it. The name Viscount was substituted after the partition of India in 1947.

The V.C.2 was not, of course, the only medium transport coming along in Britain. Towards the end of 1945 the Brabazon Committee had become concerned over the rate of progress with the project, with the result that four other companies were invited to tender designs for a Brabazon IIB type as described in the M.o.S. Specification 16/46. After studying designs by Handley Page, Short, Armstrong Whitworth, and Blackburn, the Ministry ordered two prototypes of the Armstrong Whitworth design, the A.W.55 Apollo, also to be powered by four Mambas. Meanwhile, Airspeed were well advanced with the piston-engined Ambassador, which had grown from one of the recommendations of the first Brabazon Committee in 1943 and was now known as Brabazon IIA. Both these aeroplanes, potentially, could compete directly with the V.C.2. But for the time being at least the most important potential customer,

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the newly formed B.E.A., was keenly interested in the project and from June, 1945, R. C. Morgan, the Corporation's chief project and development engineer, was closely associated with each stage of the project.

Throughout 1946 and 1947, with the shape and size of the aeroplane now settled, Vickers, B.E.A. and the Ministries continued to give much thought to the powerplant. In addition to a four-Naiad version, Vickers also studied the use of two Napier E.128D Double Naiads, and a brochure of August, 1947, described a "Viscount Mk. II" with four Naiads, having increased fuel capacity for 1,135 naut. miles with max. payload, and a max. range of 1,525 naut. miles (still air, no reserves). By this time the Dart was showing its superiority over the Mamba and the M.o.S. instructed Vickers to complete the second prototype with these engines (with which it became the V.630); the first prototype was subsequently converted for Darts and Vickers proposed to use Naiads in their own third aircraft (the V.640).

In the autumn of 1947 the first seeds of doubt about the operating economics of the Viscount were sown by B.E.A. A study was made of the V.C.2 with four Mambas, four Merlin 22, four Twin Wasps and two Centaurus 57 (the Ambassador powerplant), and this showed that the version with four Merlins was the most attractive and that the design needed to be "stretched" to take advantage of the turboprops. At the same time, B.E.A. and the Ministries were being subjected to increasing pressure by Airspeed, who had the prototype Ambassador in the air and needed a production decision quickly.

Vickers now prepared a number of alternative proposals (since described by Sir George Edwards as "hysterical defensive measures") which included a 32-passenger version with a bigger wing and two Hercules engines, and a stretched V.C.2 with four Darts or two Centaurus (Types 652 and 653). There was even a project study using two Darts inboard and two Nene turbojets outboard. B.E.A. liked the stretched aeroplane, with 40 seats, and were prepared to order it either with two Centaurus (for eventual conversion to Darts) or with Darts from the outset.

With two Centaurus and 40 seats, however, the V.C.2 was now closely similar to the Ambassador, a provisional order for 20 of which had been placed by the M.o.S. at the end of 1947. Unwilling to face a public show-down with Airspeed over its aircraft procurement policies, the Government prevailed upon B.E.A. to confirm the Ambassador order instead of buying the Viscount. This it did in August, 1948.

The fortunes of the Viscount were now at rock-bottom and for several months the whole future of the project was balanced on a knife edge. Vickers abandoned construction of the third prototype and slowed down the second, as interest in the commercial aircraft market began to wane inside the company itself—at this time becoming increasingly committed to Valiant and Varsity production.

To one man, more than any other, must go the credit for keeping the project alive at this time, and that man is Sir George Edwards. His own enthusiasm for the type never wavered and it was matched, eventually, by that of Peter Masefield, who became chief executive of B.E.A. in October, 1949. Within the company, Edwards was steadfastly supported by the late Sir Hew Kilner, managing director of the aircraft division, while Sir Alec Coryton, then Controller of Supplies (Air), and Cyril Musgrave, the U.S. (Air) at the M.o.S., continued to give what support they could.

The first flight of the Viscount 630, G-AHRF, on July 16, 1948, brought a small crumb of comfort. It proved to be a delightful aeroplane to fly and, since it was the World's first turboprop transport, it was to demonstrate just what this kind of travel offered to the passenger. Refinements in the design of piston-engined transports have today narrowed the gap somewhat, but in 1948 the difference between the Viscount and the DC-3s, DC-4s, Constellations, Convairs and Vikings then in service was dramatic.

Vickers' faith in the Dart now also began to be justified and the prospect of the 1,550 e.h.p. Dart R.Da.3 (nearly 50% more powerful than the engines in the prototype) made it possible to "stretch" the design in several directions. A 43-seat version of the V.630 with these engines and a weight of 45,000 lb. did not appeal to B.E.A., but towards the end of 1948 further projects were made using the new Dart in the larger 40-seat airframe which had already been considered. This looked much more promising, and with B.E.A. anxious to see this type built, the M.o.S. found ways and means of ordering one prototype. This was made possible by diverting the second V.630 to military research flying (fitted with two Rolls-Royce Tay turbojets, it was used to develop the Valiant's powered flying controls). The funds thus made available were used to pay for the new prototype, in the manufacture of which Vickers used many components originally intended for their own third Viscount.

The new, enlarged Viscount was first studied under the project number 655 and was built as the V.700 to M.o.S. Specification 21/49. Realizing that all was now at stake, Vickers concentrated every effort on rapid design and construction. Starting in January, 1949, a small group of project designers, led by E. E. Marshall and A. J. Thorne, converted the 630 design to have 60 in. more wing span and 80 in. more fuselage length, disposed equally about the main spar. The engine nacelles were completely redesigned to contain the R.Da.3 engines; the main undercarriage legs were offset in the inner nacelles; and the petal cowlings—hinged on the airframe—were introduced. New fuel systems, tanks and de-icing were also designed. The Viscount 700 started at a weight of 48,000 lb., later increasing to 50,000 lb. It flew on April 19, 1950, 18 months after the M.o.S. contract was placed.

Before the first flight Vickers made further proposals showing accommodation for up to 53 passengers. These proposals immediately revived B.E.A.'s enthusiasm for the Viscount, which now had been stretched in the way the Corporation had suggested a year previously and had estimated economic characteristics much in advance of those of the 630. Flight trials with the latter meanwhile continued to go extremely well, with a full passenger-carrying C. of A. it went into scheduled service with B.E.A. on July 29, 1950, for a month's operational evaluation—which left the Corporation in no doubt about the turboprop's appeal to travelling public and airline operator alike.

On August 3, 1950, came the event for which Vickers had had to wait more than five years—the receipt of a production order for Viscounts. The order came from B.E.A. and was for 20 aeroplanes of the V.701 type—slightly refined versions of the V.700. Another two years eight months were to pass before the V.701 went into service with B.E.A.—on April 17, 1953—but by then the Viscount's future had been assured. Some of the steps in developing the original 630 into the Viscount 810 of today are related on the following pages.

Two previously unpublished photographs taken on July 16, 1948, at Wisley, when the prototype Viscount 630 made its first flight. The pilot was the late Captain J. "Mutt" Summers, accompanied by G. R. "Jock" Bryce.

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Refining the Design

THE latest Viscount in service is now certificated for a gross weight very nearly twice the figure shown in the earliest V.C.2 brochure—and the aircraft is by no means at the end of its development life yet.

Clearly, an enormous amount of design development has taken place—a fact which can be illustrated, among other ways, by considering the design effort in terms of man-hours. In round figures, it took 300,000 man-hours (design office draughtsmen) to design the original V.630 and another 200,000 for the original V.700. Compared with this total of half a million man-hours, another 2,650,000 had been expended up to the middle of 1958 on productionizing and developing the many Viscount variants. To date, therefore, 3,150,000 man-hours have been spent on the Viscount in the design office, and this figure excludes design and draughting activities of the stress office, aerodynamics department, laboratory, wind tunnel and flight test department.

Much of the later design effort has gone into meeting the specific demands of individual operators. To date, for instance, there have been some 40 different interiors and six quite distinct flight deck layouts in the Viscount. Customers' requirements for the interior cover 4- or 5-abreast seating (and mixtures of the two); one or two toilets, one or two pantries, toilets at the back and pantries at the front, or vice versa; two-crew or three-crew control cabins; and carry-on baggage compartments.

Closely associated with interior layout design and specific customer requirements is the air conditioning system. A two-crew cockpit, as required for North American customers, requires automatic temperature controls. Both T.C.A. and Capital required heating on the ground and Capital also wanted additional refrigeration by a Freon unit. Of all the engineering changes made on the Viscount, this has in fact been the most difficult to resolve in the available time.

Once the design of the V.700 had been established, the first major design effort was on the V.701 for B.E.A., and was concerned with "productionizing," achieving interchangeability and introducing under-floor freight holds and seat rails. The V.701, with four Dart R.Da.3 (Mk. 505) engines and a 10-in. stroke undercarriage, had an initial design weight of 56,000 lb.; it started its operational life at 57,000 lb., which increased to 58,500 lb., and then to 60,000 lb. after fitting R.Da. 3 (Mk. 506) engines with a slightly higher cruising rating.

An interesting development quite early on in the Viscount's life was the introduction of additional tankage in the V.720 for Trans-Australia Airlines, to make possible economic operation over the long Adelaide-Perth stage (1,218 naut. miles). Extra tanks for 230 Imp. gallons were provided in the inner wing and 145-gallon slipper tanks to be carried externally on the outer wings were developed.

Probably the most important customer Vickers has had for the Viscount is T.C.A., whose first order for 15 aircraft of the V.724 variety was placed in November, 1952. This was the first North American order, and many of the modifications required by T.C.A. were later to be listed by the C.A.A. among the special conditions required for an American C. of A. The design effort on the T.C.A. type was concerned with introducing American equipment, American styling, four-tank fuel system, two-crew cockpit, air-conditioning changes, Nesa-glass windscreen and bushed spars (which are discussed later). With a design weight of 60,000 lb. the aircraft was given a 12-in. stroke undercarriage.

When the highly important order from Capital Airlines materialized in 1954, and American certification was initiated, Vickers found they had already complied with 19 of the C.A.A.'s "special conditions" in the production of the T.C.A. aeroplane. Special features for the V.745 for Capital were the Freon installation already mentioned, paddle-blade propellers, weather radar and airsteps. As explained later, an extensive wing modification was also necessary.

The V.745 was the first Viscount to take advantage of the next stage in Dart development, the 1,740 e.h.p. R.Da.6 (Mk. 510). The extra power of this variant brought with it an increase in gross weight to 63,000 lb. and later to 64,500 lb.

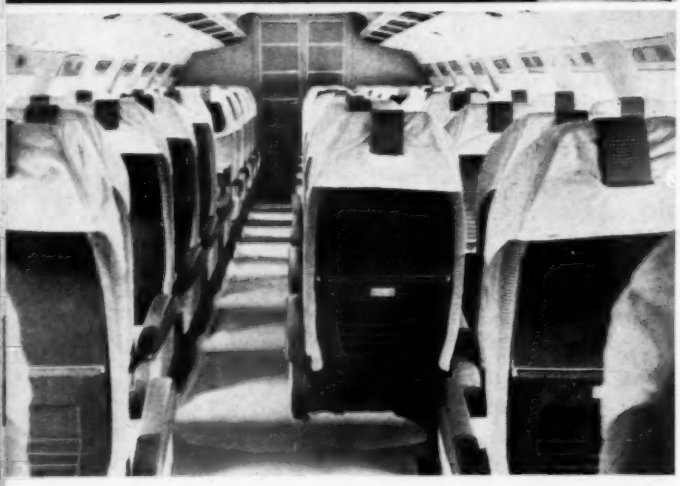
To satisfy the C.A.A. requirement that max. t.-o. weight should not be more than 105% of max. landing weight (in lieu of fuel jettisoning), the original design landing weight of the V.745 was increased to 57,500 lb., compared with 54,000 lb. for the T.C.A. aeroplane, when both types had a gross weight of 60,000 lb. This in turn required the development of a 14-in.-stroke undercarriage. The later increase in gross weight beyond 60,000 lb. has made it necessary for a fuel-jettisoning system to be fitted to the American aircraft.

From work done on the variants for T.A.A. (720), T.C.A. (724) and Capital (745), Vickers formulated a new Standard Specification for the Viscount 700, known (with R.Da.6 engines) as the 700D, and sold as far as possible on a standard components basis with such items as furnishings, radio and electrics being individually specified. The cruising speed of the 700D increased to 326 m.p.h., compared with the 300 m.p.h. of the original V.700 prototype.

Around the uprated 1,690-e.h.p. Dart R.Da.5 Vickers projected, in 1952, a further stretched version with a fuselage length greater by 13 ft. 3 in. than that of the V.700. The gross weight of this V.800 was to be 65,000 lb., with accommodation for as many as 86 passengers; speed would have been rather less than 300 m.p.h. A contract for 12 of these, with the customer designation V.801, was placed by B.E.A. on February 11, 1953.

Further consideration of this design, both by Vickers and by B.E.A., led to the conclusion, however, that the "stretch" had been overdone and, with the coming of the 1,740-e.h.p. R.Da.6, an alternative proposal was drawn up with the fuselage stretched by only 3 ft. 10 in., but the rear pressure bulkhead moved aft to increase the effective cabin length by 9 ft. 3 in. Accommodation was for up to 65 passengers and cruising speed was 320 m.p.h. at a design gross weight of 63,000 lb. B.E.A. replaced their original order for the 801 variant by an order for these new V.802s on April 14, 1954, with an option on 10 more, taken up a year later. The design effort on the 802 covered the longer fuselage, new bulkhead position, revision of tailplane incidence, rectangular doors and a general "new look" and greater flexibility.

One of the ways in which flexibility was achieved was to provide for the carriage of freight in lieu of passengers in the



Three illustrations showing variety in Viscount interiors. Top to bottom are the distinctly utilitarian V.700 interior; a V.I.P. lounge at the rear of the first V.794 for Turkey; and the B.E.A. Viscount 802 with Short Bros. seats.

forward end of the main cabin. This in turn called for the redesign of the front loading door for the use of a fork-lift for freight loading, and rectangular doors replaced the elliptical doors, both front and rear, which had been a feature of the Viscount 700 series.

In the original V.C.2 design, every opening of any significant size in the pressure cabin was designed on the principle of the "neutral hole," even the cockpit opening being an approximation to a bubble blown from a neutral hole. In the design of the V.701 for B.E.A. some departure from this ideal was necessary with the introduction of the underfloor freight holds with rectangular access doors. The rectangular doors on the

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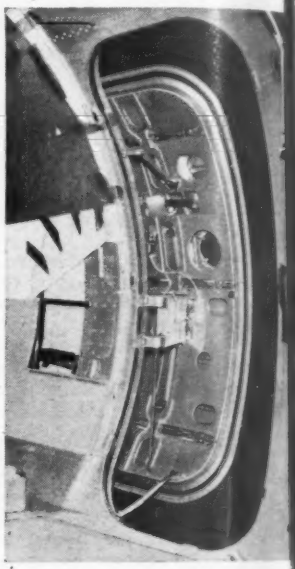
V.800 series are a further concession to customer requirements.

The 800 series has itself given birth to the 810-840 series, on which a separate note appears on pages 99-102 with a cutaway drawing on pages 100-101. By 1960, when the Dart R.Da.11 becomes available, the Viscount will be able to offer a cruising speed of around 400 m.p.h., an increase of nearly 40% over that of the original 630. The max. payload of the Viscount 810, at 15,000 lb., is just twice the payload originally required in the M.o.S. specification.

Early this year another interesting Viscount was announced. This is the V.790, for local service operators, especially in the U.S.A. The particular requirement in this variant was to be able to fly a series of short stages without intermediate refuelling or ground servicing, and with the minimum of traffic-handling facilities. The V.790 was based on the Dart R.Da.3 (Mk. 506), in favour of later versions, because of its greater background of operating experience, but the use of the high-activity Rotol trapezoidal propeller, developed for the Dart 510, gives the V.790 a take-off thrust approximately the same as the V.700D. Accommodation can be provided for up to 65 passengers.

Another design change on the V.790 is the reduction in cabin differential from 6.5 to 4.5 p.s.i. by deleting two of the blowers. Capacity of the batteries is increased for engine starting when necessary. Nos. 1, 2 and 3 engines have propeller brakes, it being intended to keep No. 4 engine running at intermediate stops to provide electric power for restarting. Airsteps are a standard feature.



The introduction of rectangular doors was a major feature of the Viscount 800 series design. This is one of the two rear doors—the front door is larger, for freight loading.

Structural Development

Apart from what can be considered as routine strengthening of the airframe for higher weights and powers, and a major structural redesign for the V.810-840, most structural development on the Viscount has been concerned with establishing and improving the fatigue life. The first repeated-load test on a half-wing specimen began in 1953, and was repeated on a second specimen after failure of the first. In both cases, failure occurred in the bottom boom of the inner plane main spar and the results showed remarkable agreement, with failures at approximately 300,000 cycles in each case.

The first major change to improve the fatigue life was made by reducing the local stress concentration round each skin-attachment bolt-hole. This was done by reducing the number of bolt-holes and fitting them with interference-fit bushes, carefully engineered to ensure that burred or damaged bushes would not be inserted. A half-wing specimen to this design was tested in August, 1954, and failed at 520,000 cycles; but this time failure resulted from initiation of frettage between the wing skin and the spar boom. The next step, therefore, was to introduce a $\frac{1}{64}$-in. Formapex plastic strip between the skin and bottom boom to prevent this frettage.

The test of the bushed spar wing was continued after a new inner spar bottom boom, with the plastic interlayer, had been fitted. This replacement spar boom fractured after another 720,000 cycles, and went again (after being repaired), after withstanding a further 560,000 cycles. This type of wing was introduced at the beginning of the T.C.A. order.

The Capital Airlines order in 1954 posed another problem, as these aircraft would be operating over very short average stage lengths involving a large proportion of flight time at low altitude and in regions of high gust density. To improve the fatigue life for these conditions, the bottom spar booms were

Various design refinements were introduced at intervals along the V.745 production line for Capital Airlines. Among them, shown here, were the radome nose, airsteps, and Dart 510 engines.

redesigned to have 50% more area, and copper-based L65 aluminium alloy was substituted for the DTD.363 used previously. This wing, with a specimen fuselage, was tested in a water tank at Weybridge, and has completed 100,000 "flights" (each representing a typical 2¼-hr. European flight) to date.

Another increase in spar strength was required for the Viscount 810, achieved by increasing the area from the break joint to the inboard end of the inner plane. The area of the centre-section boom is also increased by 28%, and the bottom root joint has been strengthened.

Production

The first two Viscounts (the 630 and the Tay-Viscount) were built in the Vickers experimental shop at Foxwarren. Both were assembled at Wisley and flown from there, respectively by J. "Mutt" Summers and G. R. "Jock" Bryce. By the time work was ready to proceed on the prototype V.700, however, Foxwarren was occupied with the prototype Valiant and other arrangements had to be made. The fuselage was built, therefore, at South Marston and the wings at Itchen, two of the Supermarine factories. This aircraft was put together at Weybridge, where the first flight was made.

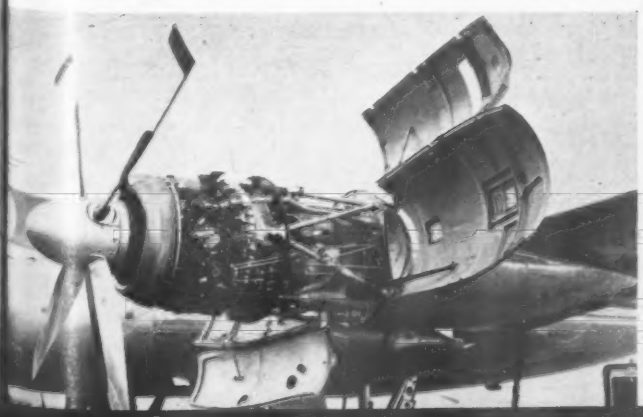
Production of the Viscount was initiated at Weybridge, where the Viking, Valetta and Varsity were being built. As orders grew it became clear that much new space was needed, even if wide use was made of sub-contractors. In 1953, therefore, Vickers decided to develop a new production unit at Hurn, where a temporary base had been established for Valiant flight trials. Eventually, 720,000 sq. ft. (about 16 acres) was taken over to provide two final assembly lines and two fuselage assembly buildings, all Viscount wings being sub-contracted.

To ease the situation at Weybridge, where the Valiant was coming into production, two large new assembly buildings were also erected, the last coming into full use about 18 months ago. At first, Hurn concentrated on major production runs (like the T.C.A. and Capital orders) while the smaller batches were built at Weybridge. With the completion of the new buildings at Weybridge, however, this division of labour has changed, and Hurn is now building most of the Series 700s while all Series 800 final assembly is at Weybridge.

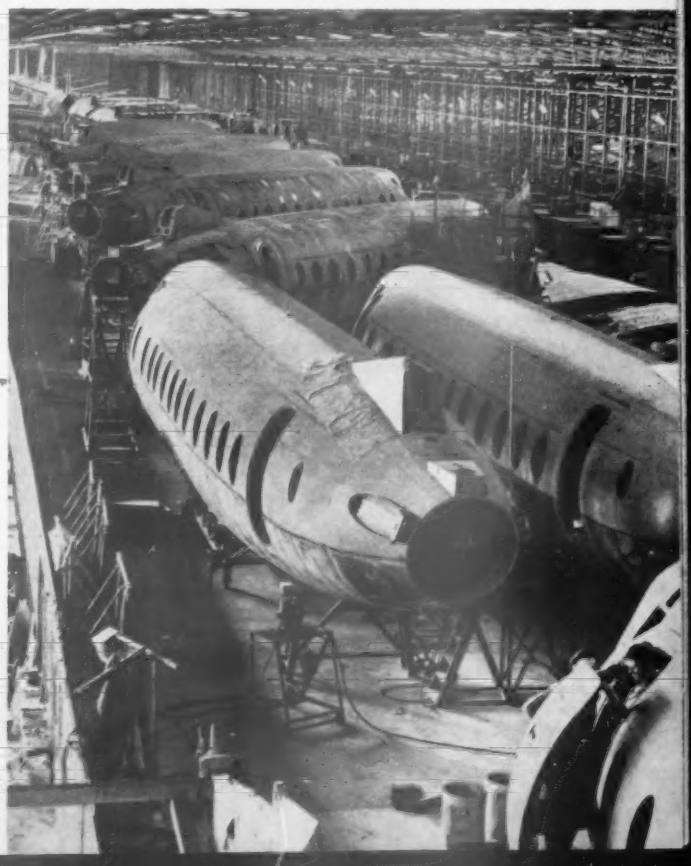
With more than a mile of production lines in all, Vickers have reached a peak production rate of more than 10 Viscounts a month, the best rate for any British post-war transport aeroplane.

An early design development on the Viscount was to introduce slipper tanks outboard of the nacelles. These tanks were first used by T.A.A. and can be fitted to any Viscount series.

The hinged nacelle cowlings which make the Dart so readily available for servicing were introduced in the process of converting the V.630 design to the V.700. The hinged portions are hung from the main airframe structure.



Below, production of the Viscount called for the establishment of four separate final assembly lines. This one, at Weybridge, shows Viscount 802 fuselages being worked on, with the wing/fuselage mating line beyond.



Viscount Orders in Detail

Operator	Total	Type	Engines	First order	First flt.	First del.	Markings	Remarks
M.o.S.	1	630	R.Da.1	Mar. 9, '46	July 16, '48	—	G-AHRF (VX212)	R.Da.4s later. Flew 931 hr. 50 min. W.O. Khartoum, Aug. 27, '52.
	1	663	Tay	Mar. 9, '46	Mar. 15, '50	—	VX217 (G-AHRG)	Ordered as V.609 with Mambas. Used for powered flying control development.
	1	700	R.Da.3	Feb. 24, '49	Aug. 28, '50	—	G-AMAV	Certification trials for V.701, then V.800 and V.810 (with R.Da.7s). Vanguard control investigation. Last flight April 1, 1958. Total hours 2,160.
Aer Lingus	4	707	Dart 506	Nov., '51	Jan. 30, '54	Mar. 7, '54	EI-AFV, 'AFW, 'AFY, 'AGI	53-seat interior. Delivery complete April, 1954.
	6	808	Dart 510	Mar., '56	May 13, '57	May 22, '57	EI-AJI, 'AJJ, 'AJK	60-seat interior. Delivery of first three complete February, 1958.
	2	745	*Dart 510*	—	*Feb. 26, '57*	*Mar. 27, '58*	*EI-AJV, 'AJW*	*Originally for Capital Airlines. Three-month charter to Aer Lingus. Now to B.E.A. (q.v.).*
Ansett-A.N.A.	4	832	Dart 525	May, '58	—	—	VH-RMG, VH-RMH	First delivery only 1959.
Air France	12	708	Dart 506	Nov., '51	Mar. 11, '53	May 18, '53	F-BGNK to F-BGNV inc.	F-BGNK w.o. December, 1956.
Airwork	3	755	*Dart 510*	*Dec. '55*	—	—	*G-AOCA to G-AOCC inc.*	*Sold to Cubana (q.v.) before completion. British markings not used.*
	2	736	Dart 506	—	Oct. 20, '55	—	G-AODG, 'ODH	Purchased from Fred Olsen. Previously used on charter by B.E.A., M.E.A., B.W.I.A
	2	831	Dart 525	April '58	—	—	G-APND, PNE	First delivery, early winter, 1958.
Alitalia-L.A.I.	10	785	Dart 510	May, '56	Mar. 12, '57	Mar. 27, '57	I-LIFE, 'IFT, 'ILI 'ARK, 'OTT, 'AKE, 'IRS, 'IZT, 'IRP, 'IZO	48-seat interior.
Austrian Airlines	4	779	Dart 510	—	Mar. 11, '57	—	OE-LAB to OE-LAE inc.	Leased from Fred Olsen.
Braathens S.A.F.E.	1	742	*Dart 510*	Sept. '54	*July 24, '56*	—	*LN-SUN*	*Sold to Brazilian Govt. (q.v.).*
Brazilian Govt.	1	742	Dart 510	Sept. '56	July 24, '56	Nov. 7, '56	FAB-2100	Purchased from Braathens S.A.F.E., ex LN-SUN. V.I.P. interior.
	1	789	Dart 510	Sept., '56	Dec. 1, '57	Dec. 23, '57	FAB-2101	V.I.P. interior, for Presidential use.
B.E.A.	27	701	Dart 506	Aug., '50	Aug. 20, '52	Jan. 3, '53	G-ALWE, 'WF; G-AMNY-'OP inc.; G-ANHA-'HF inc.; 'OFX	First Viscounts in service. Dart 505s at first. G-ALWE w.o. March 14, 1957.
	2	736	*Dart 506*	—	*Oct. 20, '55*	—	*G-AODG, G-AODH*	*Fred Olsen (ex LN-FOF, LN-FOL) on two-year charter. See Airwork.*
	24	802	Dart 510	Feb., '53	July 27, '56	Feb. 14, '57	G-AOJA-'JF inc.; G-AOHG-'HW inc.; 'ORC, 'ORD	G-AOJA w.o. Oct. 23, '57; G-AOHP w.o. Nov. 17, '57; G-AORC w.o. April 28, '58.
	18	806	Dart 520	Jan., '56	Oct. 4, '57	Mar. 29, '58	G-AOYG-G-AOYT inc.; G-APEX, 'EY, 'IM, 'JU, KF	First B.E.A. mixed-class (59-seat) interior.
	2	745	*Dart 510*	Jan., '58	*Feb. 26, '57*	—	*G-APNF, G-APNG*	*Three-month charter to B.E.A. Ex EI-AJV, AJW, Aer Lingus (q.v.).*
B.W.I.A.	4	702	Dart 506	June, '53	June 17, '55	July 28, '55	VP-TBK to VP-TBM inc.	44/53-seat interior. Delivery complete November, 1955.
	1	736	*Dart 506*	—	Nov. 8, '55	—	*VP-TBY*	*Short-term lease from Fred Olsen prior to sale to Airwork (q.v.).*
	4	772	Dart 506	June, '55	Oct. 6, '57	Oct. 25, '57	VP-TBS to VP-TBV inc.	Delivery complete January, 1958.
Butler Air Transport	2	747	Dart 506	June, '54	Sept. 15, '55	Sept. 27, '55	VH-BAT, VH-BUT	Registered G-ANXV and G-ANYH for delivery flights.
Canadian Govt.	1	737	Dart 506	April, '54	Mar. 15, '55	Mar. 28, '55	CF-GXK	For Department of Transport.
	1	745	Dart 510	Mar., '58	Mar. 21, '58	Mar. 28, '58	CF-DTA	For D.O.T. Originally built for Capital and flown on April 28, '57. Ex G-APFR.
Capital Airlines	3	744	*Dart 506*	*June, '54*	*May 14, '55*	*June 15, '55*	*N7402 to N7404 inc.*	*One w.o. in U.S.A., two returned to Vickers (q.v.), 1958.*
	60	745	Dart 510	Aug., '54	Nov. 9, '55	Nov. 14, '55	N7405 to N7452; N7454 to N7465	Original order for 57 complete March '57; three more in 1960. Two w.o. 1958.
Central African	5	748	Dart 510	July, '54	Mar. 28, '56	May 1, '56	VP-YNA to VP-YNE inc.	47-seat interior. Delivery completed July, 1956.
Cubana	3	755	Dart 510	Dec., '55	April 26, '56	May 16, '56	CU-T-603 to CU-T-605 inc.	Purchased from Airwork before delivery, ex G-AOCA to G-AOCC inc.
	4	818	Dart 525	June, '56	—	—	CU-T621 to CU-T624 inc.	52-seat interior. First delivery Autumn, 1958.
Continental Airlines	15	812	Dart 525	Dec., '55	Feb. 14, '58	May 10, '58	N240V to N254V inc.	First 810 Series in service, May, 1958.
Cyprus Airways	2	754	*Dart 510*	June, '55	—	—	*G-APCD, G-APCE*	*Part of B.O.A.C. order, diverted to Middle East Airlines before delivery.*
Eagle Aviation	2	805	Dart 510	May, '57	Dec. 2, '57	Dec. 19, '57	G-APDW, G-APDX	G-APDW assigned to Eagle (Bermuda), April 19, 1958, as VR-BAX.
Fred Olsen	2	736	*Dart 506*	*Jan., '54*	*Oct. 20, '55*	*Nov. 18, '55*	*LN-FOF, LN-FOL*	*Two-year lease to B.E.A. (q.v.), then sold to Airwork (q.v.).*
	4	779	*Dart 510*	*June, '55*	*Mar. 11, '57*	*April 30, '57*	*LN-FOH, 'FOI, 'FOK, 'FOM*	*Leased to Air Austria (q.v.).*
Hong Kong Airways	2	760	Dart 510	Oct., '54	Dec. 13, '56	Jan. 1, '57	VR-HFI, VR-HFJ	40-44-seat interior. Delivered February, 1957.
Hughes Tool	1	763	Dart 510	June, '55	—	—	—	Completed November, '56, with V.745-type interior. In storage at Weybridge.
Hunting-Clan	3	732	Dart 506	May, '53	April 26, '55	May 11, '55	G-ANRR to G-ANRT inc.	Chartered to B.E.A. (1) and M.E.A. 1955-1956. Returned September, 1957.
	2	759	*Dart 510*	*Nov., '54*	*Nov. 2, '56*	*Nov. 16, '56*	*G-AOGG, G-AOGH*	*Sold to Icelandair (q.v.) before service.*
	3	833	Dart 525	May, '58	—	—	—	For delivery early 1959.
Icelandair	2	759	Dart 510	—	Nov. 2, '56	Nov. 16, '56	—	Purchased from Hunting-Clan.
Indian Air Force	1	723	Dart 506	Nov., '53	Nov. 8, '55	Dec. 29, '55	IU-683	V.I.P. interior.
	1	730	Dart 506	Nov., '53	Dec. 14, '55	Jan. 13, '56	IU-684	V.I.P. interior.
Indian Airlines	10	768	Dart 510	July, '55	July 30, '57	Aug. 19, '57	VT-DIO, 'DIF to 'DII inc., 'DIX, 'DIZ, 'DJA to 'DJC	44-seat interior. Delivery completed June, 1958.
Iranian Govt.	3	782	Dart 510	Mar., '56	Mar. 4, '58	Mar. 25, '58	EP-AHA to EP-AHC inc.	—
Iraqi Airways	3	735	Dart 506	July, '53	Sept. 23, '55	Oct. 13, '55	YI-ACK to YI-ACM inc.	Delivery completed December, 1955.
	1	773	Dart 506	Mar., '56	Oct. 30, '57	Nov. 18, '57	YI-ACU	Delivery completed November, 1957.
	1	732	*Dart 506*	—	—	—	*YI-ADM*	*Temporary lease of Hunting-Clan G-ANRT, mid-'58.*
Kaysam Investment	3	786	*Dart 510*	Sept., '56	*July 5, '57*	*Aug. 23, '57*	*HK943, HK941, HK946*	*Ordered for Lloyd Aereo Colombiano. Two sold to LANICA before delivery.*
K.L.M.	9	803	Dart 510	June, '55	April 5, '57	June 6, '57	PH-VIA to PH-VII inc.	53-63-seat interior. Delivery completed December, 1957.
LANICA	2	786	Dart 510	—	Dec. 23, '57	Jan. 23, '58	AN-AKP, AN-AKQ	Purchased from Kaysam Investment Corp. before delivery, ex HK941 and HK946.
L.A.V.	3	749	Dart 506	May, '54	Jan. 19, '56	Feb. 28, '56	YV-C-AMV, 'AMX, 'AMZ	40-seat interior. Delivery completed March, 1956.
Lufthansa	9	814	Dart 525	May, '56	—	—	D-ANUN, NOL, NAD, NIP, NUR, NEF, NIZ, NAM, NAB	54-60-seat interior.
Middle East Airlines	3	732	*Dart 506*	—	*April 26, '55*	—	*OD-ACF to OD-ACG inc.*	*Two- and one-year charter from Hunting-Clan to autumn, 1957.*
	1	736	*Dart 506*	—	*Oct. 20, '55*	—	*OD-ACR*	*Short-term charter from Fred Olsen before sale to Airwork, 1957.*
	7	754	Dart 510	June, '55	July 17, '57	July 27, '57	OD-ACT to OD-ACX inc., OD-ADD, 'ADE	Ordered by B.O.A.C. OD-ADD, 'ADE originally allocated to Cyprus Airways (q.v.).
Mitrair	3	739	Dart 506	Mar., '54	Dec. 1, '55	Dec. 23, '55	SU-AIC to SU-AIE inc.	One destroyed in bombing of Almaza Airport, Cairo, October, 1956.
	2	739A	Dart 506	—	—	—	SU-AKN, SU-AKO	Delivery completed January, 1956.
N.Z.N.A.C.	3	807	Dart 510	Nov., '55	Dec. 11, '57	Dec. 31, '57	ZK-BRD to ZK-BRF inc.	—
Niarchos	1	819	Dart 525	Nov., '56	—	—	VS-O6C	V.I.P. interior.
Pakistan Govt.	1	734	Dart 506	Mar., '55	Feb. 29, '56	Mar. 20, '56	J751	V.I.P. interior.
Pakistan I.A.L.	3	815	Dart 525	May, '56	—	—	AP-AJC to AP-AJE inc.	51-seat interior. First delivery Autumn, 1958.
Philippine Air Lines	2	784	Dart 510	April, '56	May 1, '57	May 10, '57	PI-C-770, PI-C-771	Both leased to TACA (q.v.).
PLUNA	3	769	Dart 510	Sept., '56	Jan. 20, '58	May 13, '58	CX-AQN to CX-AQP inc.	48-seat interior.
South African Airways	7	813	Dart 525	Mar., '56	—	—	ZS-CDT to ZS-CDZ inc.	56-seat interior. Firt delivery late Summer, 1958.
South African Govt.	1	781	Dart 510	Mar., '56	May 18, '58	June 16, '58	150	V.I.P. interior. Handed over, June 16; now being finished.
Standard Oil Co.	1	765	Dart 510	June, '55	Jan. 24, '57	Feb. 11, '57	N306	Executive interior.
TACA	2	784	*Dart 510*	—	Sept. 5, '57	—	*VS-O6C*	*Leased from Philippine Air Lines.*
Transair	3	804	Dart 510	June, '55	Aug. 31, '57	Sept. 17, '57	G-AOXU, G-AOXV, G-APKG	53-65-seat interior.
T.A.A.	7	720	Dart 506	June, '52	Aug. 29, '54	Oct. 5, '54	VH-TVA to VH-TVG inc.	VH-TVA w.o. October 31, 1954.
	7	756	Dart 510	April, '55	May 3, '56	June 3, '56	VH-TVH to VH-TVL inc.	Two to be delivered later this year.
	1	745	*Dart 510*	—	*Mar. 8, '58*	*Mar. 14, '58*	*VH-TVO*	*Originally for Capital Airlines, first flown as N7465 on April 10, '57. Six-month charter.*
T.C.A.	15	724	Dart 506	Nov., '52	Oct. 13, '54	Dec. 8, '54	CF-TGI to CF-TGW inc.	44-seat interior. Delivery completed February, 1956.
	36	757	Dart 506	Aug., '54	Mar. 18, '56	Mar. 28, '56	CF-TGX to CF-TIG inc.	—
Turkish Airlines	5	794	Dart 510	July, '57	Jan. 9, '58	Jan. 21, '58	TC-SEC, 'SEL, 'SES, 'SET, 'SEV	—
Union of Burma Airways	3	761	Dart 510	May, '55	June 26, '57	July 27, '57	XY-ADF, XY-ADG	48-seat interior. Delivery completed October, 1957.
U.S. Steel Corp.	3	764	Dart 510	June, '55	Oct. 2, '56	Dec. 4, '56	N905 to N907 inc.	Executive interior.
V.A.S.P.	5	822	Dart 525	May, '57	—	—	PP-SRC to PP-SRG inc.	For delivery late Summer, 1958.
Vickers	1	806A	Dart 525	—	Aug. 9, '57	—	G-AOYF	First 806, with uprated engines. Crash-landed Johannesburg October 20, 1957.
	1	810	Dart 525	—	Dec. 23, '57	—	G-AOYY	Prototype of 810 series for certification trials.
	2	744	Dart 506	—	May 14, '55	—	G-APKJ, G-APKK	Repurchased from Capital Airlines.

Viscount's Tenth Anniversary . . . .

The Viscount 810

ON May 28, 1958, the Viscount 812 went into service in the U.S.A. with Continental Airlines, the second major American domestic operator to use Viscounts. The 812 is the first production variant of the 810 series and is the latest type to go into service. It embodies a wealth of operating experience gained throughout the World with earlier Viscounts and also the wide background of engineering experience which has been progressively built up from airline service and the extensive testing and detail development over the past 10 years.

The basic philosophies underlying the design of the structure and systems remain unaltered, having successfully accumulated over one million operating hours, and the inherent simplicity of the Viscount design is retained. However, a number of changes and a certain amount of strengthening have been necessary for the higher design weights and speeds of this type when compared with the earlier 700 and 800 Series aircraft. Whilst numerous minor structural improvements have been progressively incorporated during the service life of the early Viscounts, as noted on previous pages, the changes on the 810 Series aircraft are the first of a major structural nature. In establishing and improving the fatigue properties the structure has also received considerable detailed attention.

The principal changes are those associated with the installation of the more powerful Rolls-Royce Dart R.Da.7/1 (Mk. 525) engines, and provision for later fitment of the R.Da.11 (Mk. 541) for conversion to the 840. The R.Da.7/1 is basically similar to the R.Da.7 Mk. 520 already flying in the intermediate Type 806 with British European Airways and is rated at 2,100 e.h.p. for cruising, derated to 1,800 s.h.p. (1,990 e.h.p.) for take-off. This latter feature affords reserve power up to I.S.A. + 6° C. before water-methanol injection is introduced as a power restorative. The later R.Da.11 is rated at 2,500 e.h.p. for cruising and will be similarly derated to 1,800 s.h.p. (2,080 e.h.p.) which allows full take-off power up to I.S.A. + 27° C. and virtually eliminates the use of water methanol.

Cruising power and performance of the R.Da.11 will make possible a cruising speed of around 400 m.p.h., which is almost as fast as the Vanguard, whilst the specific fuel consumption is almost the same as the early Viscounts, some 75 m.p.h. slower and 5 tons lighter in gross weight. The nacelles and engine mountings to house these more powerful engines have needed to be strengthened and improved.

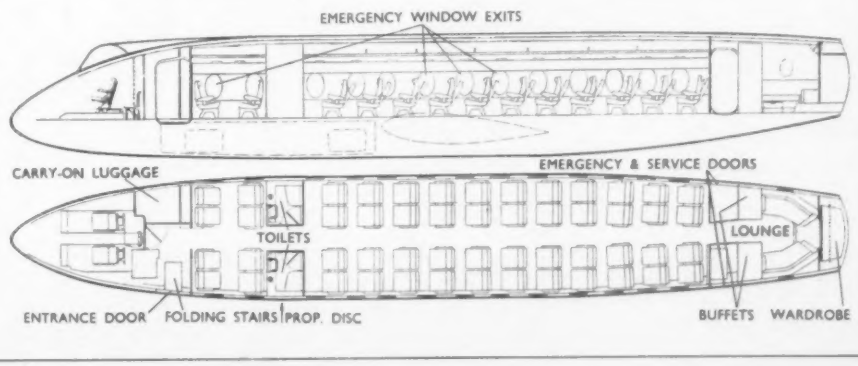
High-activity (160-factor) propellers, with trapezoidal plan form, for improved short field performance, have been fitted, and automatic synchronization is standard.

The increased indicated airspeed and higher design weights have necessitated strengthened wing rib and spar structure. The introduction of a strengthened and longer stroke undercarriage with improved brakes for the necessary kinetic-energy absorption has also been necessary. The rear fuselage has received attention to cater for the higher tail loads and the fin has been strengthened to deal with the higher asymmetric loads in the engine failure cases.

Rudder power has been increased by using larger deflections, and the elevator power has been improved by a redesigned spring tab system, in order to maintain the existing c.g. range with the more powerful engines. The larger rudder deflections have been made possible by adjusting the forward balance of the control. The gaps between the leading edges of the rudder and elevator and the main surfaces have been improved in the light of earlier Viscount experience to avoid the collection of snow. These improvements have already been extensively evaluated with the V.700 prototype, G-AMAV, and general handling qualities at speeds around 400 m.p.h. have been satisfactorily investigated with this aircraft at low weight and uprated engines (R.Da.7s).

The fuselage structure is substantially similar to that of the Viscount 800 Series. Important changes in the 800 Series, as already noted, include the introduction of rectangular access doors in place of the familiar elliptical type of earlier machines. These doors, with their simple, positive latching mechanism, represent an effective compromise between simplicity, airworthiness and functionality. With the exception of the small freight door at the rear of the fuselage on the starboard side, when a freight compartment is fitted, the doors are operated with an outward-opening parallel-link mechanism to ease handling in high winds. On the Viscount 812 the forward passenger door on the port side incorporates retractable passenger steps of the kind which have been successfully fitted to the Capital Airlines

(*Continued on page* 102)



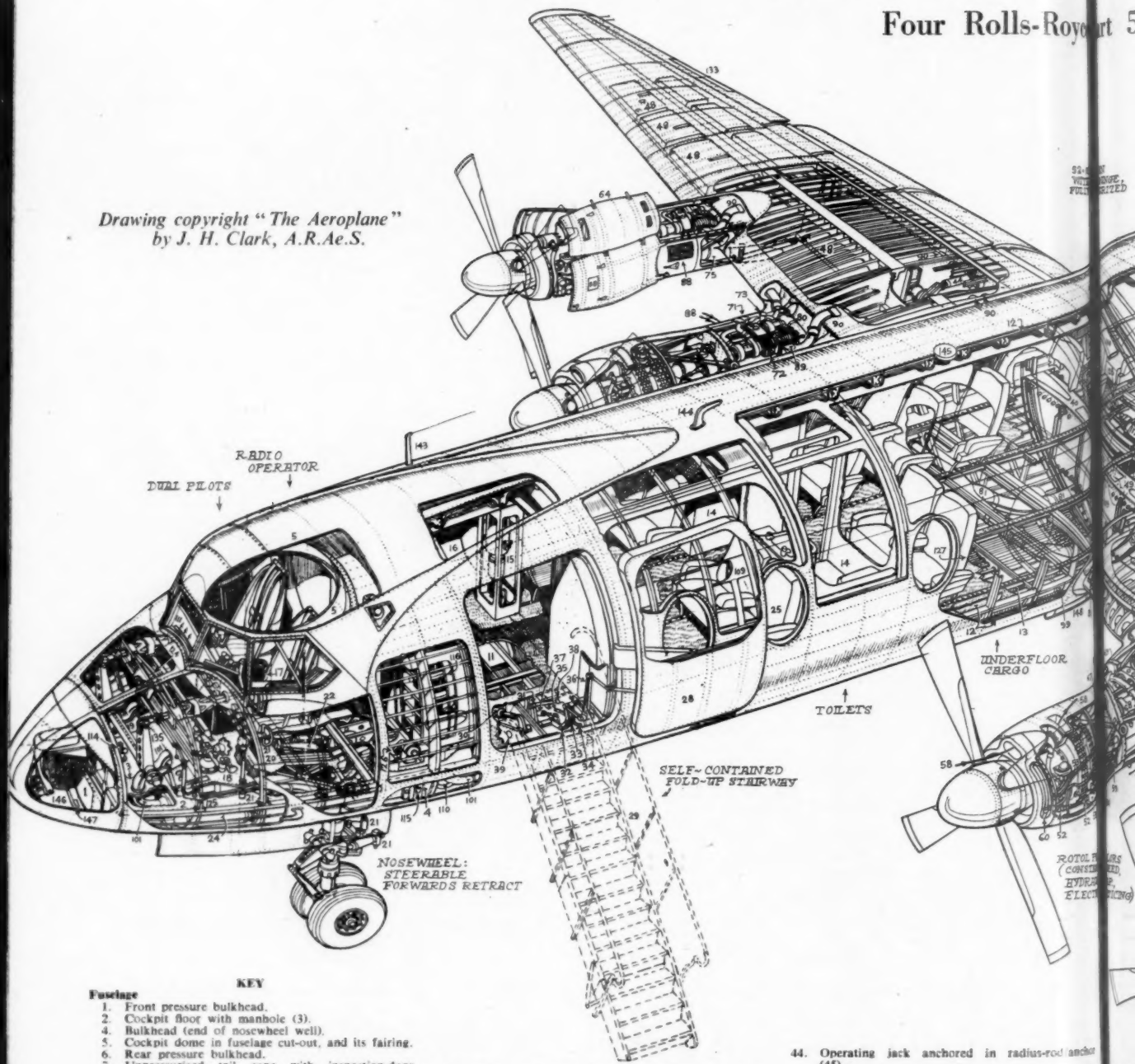
This layout of the Continental Airlines Viscount 812 makes an interesting comparison with the original scheme shown on page 93. Maximum accommodation in the Viscount 810 series is for 75 passengers.

1958
Union of Burma Airways
U.S. Steel Corp.
Vickers
Dart 510 761 May, '55 June, '55 May, '57
Dart 510 764 — — —
Dart 525 827 June 26, '57 Oct. 2, '56 —
Dart 525 806A Aug. 9, '57 Dec. 23, '57 May 14, '58
Dart 525 810 July 27, '57 Dec. 4, '56 —
Dart 526 744 — — —
3 3
XY-ADF, XY-ADG
N905 to N907 inc.
PP-SRC to PP-SRG inc.
G-AOYF
G-AOYY
G-ANAJ, G-APKK
48-seat interior. Delivery completed October, 1957.
Executive interior.
For delivery late Summer, 1958.
First 806, with uprated engines. Crash-landed Johannesburg October 20, 1957.
Prototype of 810 series for certification trials.
Repurchased from Capital Airlines.

The Vickers Viscount 812

Four Rolls-Roy[illegible]rt 5

Drawing copyright "The Aeroplane" by J. H. Clark, A.R.Ae.S.



KEY

Fuselage

1. Front pressure bulkhead.
2. Cockpit floor with manhole (3).
4. Bulkhead (end of nosewheel well).
5. Cockpit dome in fuselage cut-out, and its fairing.
6. Rear pressure bulkhead.
7. Unpressurized tail cone with inspection-door underneath.
8. Built-in fan.
9. Fin attachment to (7).
10. Tailplane main-spar attachment crossbeam and double frame.
11. Underfloor loading hatches.
12. Semi-monocoque structure.
13. Side wall to underfloor baggage compartment.
14. Port and starboard toilet compartments.
15. Hydraulic-system pump and tank in cupboard.
16. Additional stowage.
17. Control console.
18. Box unit enclosing all control linkages and carrying pilot's seat.
19. Box mounting for second pilot's seat.
20. Unit (18) and floor cutaway to reveal nosewheel mounting structure (20).
21. Nosewheel hydraulic hand-steering (each side).
22. Nosewheel retraction jack anchored to (20).
23. Not used.
24. Pneumatic-system tanks (underfloor) for door sealing.
25. Double windows. Triple windows at Nos. 1, 2 and 3 each side.
26. Galley.
27. Aft lounge, and cloakrooms (28).
28. Parallel-link-hinge doors.
29. Three-piece folding stairs.
30. Operating jack (30) rocks lever (31) to pull stairs UP and at same time lifts (32) and sends (33) up slot (34); further motion of jack and point (32) drags (33) down slot to (35) pulling (36) and door after it, by which time stairs are up and folded.
37. Spring assister.
38. Connection to stair-head (stair fulcrum is nearer to the point (39)).

Wing

40. Main-spar tongued attachment.
41. Front and rear auxiliary spars plug-in attachment.
42. Undercarriage main hinge (with side-play to one journal for wing expansion).
43. Undercarriage leg-break with forwards retraction of lower limb and swing back for top limb.
44. Operating jack anchored in radius-rod anchor (45).
46. Undercarriage doors worked by lifting beam (46) raised by uprising leg.
47. Outer-plane main-spar attachment and auxiliary plug-in attachments.
48. Twelve fuel (kerosene) tanks per wing (including two inboard of inner engines) with balance-pipes across fuselage as at (49).
50. Fuel tank showing on port root.
51. Water-methanol tank showing on port root.
52. Fuel pump with filter and pipins (see "Engines").
53. Water-methanol pipe.
54. Fuel-tank bags with projecting rubber buttons for attachment to cell plating (55).
56. Fuel-cell plating with small holes (57) into which buttons (55) "press-stud" home to secure bags.

Engines

58. Oil cooler and cooling air IN and OUT.
59. Firewalls.
60. Spray rings (with (60a) below the combustion chambers).

rt 525 Turboprops

Pressurization (contd.)

110. Branch-off forward warm-air duct (99) to demisting blower on rear face of bulkhead feeding windscreen demisting units (111).
112. Used air ducted via toilets, freight compartment and rear lounge underfloor to three discharge valves (112).
113. Safety valve.
114. Inwards relief valve (see bulkhead (1)).
115. Ground-pressure test connection.
116. Port radio rack ducting with underfloor extractor fan.

Flaps

117. Electric motor and shafting drive chains (118) carrying member (119) in and out.
120. Member (119) attached to flap-slat.
121. Roller on outrigger guides flap via profile slot (122).
123. Telescopic-arm radius rod.

Ailerons

124. Pilots' handwheels drive chainwheel (124) and linkage (125), thence via autopilot servo (126), underfloor runs (127), cross-shaft rig (128) to outside of box on inside skin of fuselage. Air-sealed spindle takes motion through to arm in unpressurized box opening into wing at (129), thence via rod (130), through rear spar at (131) on to link (132).
133. Electrically actuated trim tab.
134. Balance tab.

Rudder and Elevators

Pilots' push-pull control and rudder bars, then through rods and linkage as (135) and underfloor (127) to (136).
136. Pressure-box similar to (129), but in rear pressure bulkhead (6).

61. Firewire circuit with detector switches (63) in accessories' bay, seven in combustion bay.
62. Fire-extinguisher bottles.
64. Improved petal cowling in four pieces with hinge points (65).
66. Spotlamp (wing leading-edge ice detection).
67. Accessories' gearbox and drive.
68. Generator.
69. Hydraulic pump.
70. Alternator and tachometer.
71. Nacelle frame encircling jet pipe and carrying gearbox (top bridge-piece shown omitted).
72. Gearbox pick-up to (71).
73. Cooling-air vents from auxiliaries.
74. Jet efflux side outlet for inboards (underneath for outboards (75)).

Anti-icing

76. Heat-exchanger saddled on jet pipe, with exhaust gases out at (77).
78. Anti-icing air IN to be heated and OUT (heated) at (79) (79) with by-pass (80) linking (79) (79).
81. Ducting (port to starboard) and aft to fin (82) and tailplane (83) leading-edges through pressure bulkhead (6) at (84).
85. Hot air along main-wing leading edge, out at louvres (86) and at wing tip.
87. Connecting duct across outboard nacelles.

Pressurization

88. Air intake to blower (actually on *starboard* side of each of the three nacelles).
89. Thence via blower (89) and duct (90), silencer (91), spill valve (92), non-return valve (93) (all repeated for each engine) into fuselage and along to secondary silencers (94), along (95), through primary intercooler (96), out at (97), along to warm-air ceiling ducts (98), with extension (99) feeding ceiling duct (100) and cockpit (101).
102. By-pass across primary intercooler.
103. Branch-off primary intercooler exit (97) to cold-air unit (103), pipe (104), secondary intercooler (105), out back to cold-air unit, through its silencer (106) to cold-air fan (107), thence out to aft cold-air ducts (108) and forward alongside (99) to forward cold-air ducts (109) (across to starboard side), all for passengers' individual cold-air supply (plus extension to cockpit).
137. Linkages to rudder post and elevator shafts with autopilot feed-ins (138).
139. Rudder combined hand-trim and spring tab.
140. Spring tab.
141. Anti-balance tab.
142. Hand-trim tab.

Radio, etc.

143. HF antenna.
144. VHF.
145. ADF loop.
146. Weather radar unit.
147. Glide-slope antenna.
148. ADF sense antenna.
149. Static dischargers.
150. VOR/ILS localizer antenna.
151. Invertors with cooling air from cabin louvres (see centre-section main spar).

The Viscount 812 went into service with Continental Airlines on May 28. This picture was taken a few days later at Los Angeles, where Continental Airlines was the first operator to introduce a regular turboprop service.

Viscount's Tenth Anniversary . . . .

(*Continued from page* 99)

Viscounts. Nose-mounted weather radar accessible through a hinged radome may be fitted and structural provision is standard. The V.812 to Continental Airlines' specification incorporates RCA AV Q10 weather radar equipment.

The wing structure remains substantially similar to earlier Viscount design with the main bending loads being taken up by a single spar at 40% of the chord. Subsidiary shear webs at 5% and 70% of the chord, together with light close-pitched ribs, complete the torsion box, there being no spanwise stringers. This arrangement has now been so thoroughly tested and evaluated both on the test rig and in the air, for both strength and fatigue properties, that it is a very well-known quantity. Many detailed improvements have been applied to the landing flap mechanism and emergency operation is now electrical instead of manual.

All three undercarriage units retract forward. New ceramic friction pad brakes and tubeless tyres are fitted.

The air conditioning and pressurization systems have benefited considerably from earlier Viscount experience. Three of the four engine accessory gearboxes drive Godfrey blowers to pressurize the cabin to a maximum working differential of 6½ p.s.i. at a rate of 75 lb./min. at 20,000 ft. A Freon refrigeration system, as developed for the Capital Viscount 745 to augment the main air conditioning system, is optional. Conditioned air is now introduced adjacent to the light fittings in the roof panels and extracted through the skirting at floor level, which is the reverse of the flow in earlier aircraft.

The fuel system consists of a 4-tank supply affording greater reliability by feeding each engine for take-off from a separate tank. The total capacity is 1,900 Imp. gallons and provision is made for fitting two 145-gallon " slipper " tanks just outboard of the outer engine nacelles. A fuel jettison system to meet American C.A.A. relanding requirements is fitted on the V.812.

Wing, tailplane and fin leading edge de-icing remain of conventional thermal type as in earlier Viscounts, being supplied from exhaust heat exchangers mounted in the inboard engine nacelles. Engine intakes and propeller spinners and blades are electrically de-iced. Windscreen protection is provided by Nesa panels, with standby fluid sprays if required.

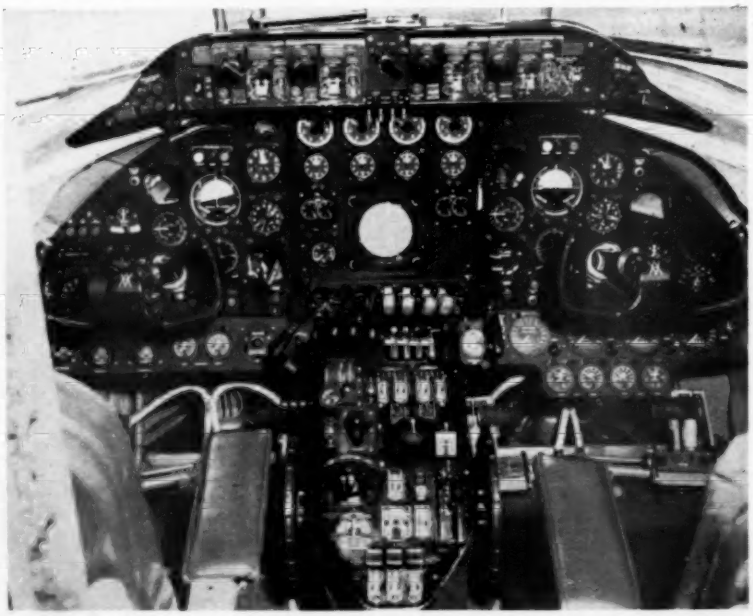
All four engine accessory gearboxes drive 9 kW. D.C. generators (earlier Viscounts were 6 kW.) which feed the main system busbar at 28-V., the distribution system is conventional. However, the generation circuit has been simplified, lightweight wiring employed, and improved batteries installed. 115-V. A.C. supply of instruments, radio and windscreen panels is derived from this system via inverters mounted under the floor. Engine intake and propeller electrical de-icing loads are derived from alternators mounted on each gearbox.

Redesign of the interior trim of the 810 has made the fuselage effectively 4 in. wider, with much more lateral headroom; four- or five-abreast seating is possible. The extra space at the rear may be effectively used as a lounge (as in the V.812), or a freight compartment. Excluding this rear compartment and the twin toilet space in the propeller plane, some 2,500 cu. ft. of usable volume is available with a further 250 cu. ft. in the underfloor compartment.

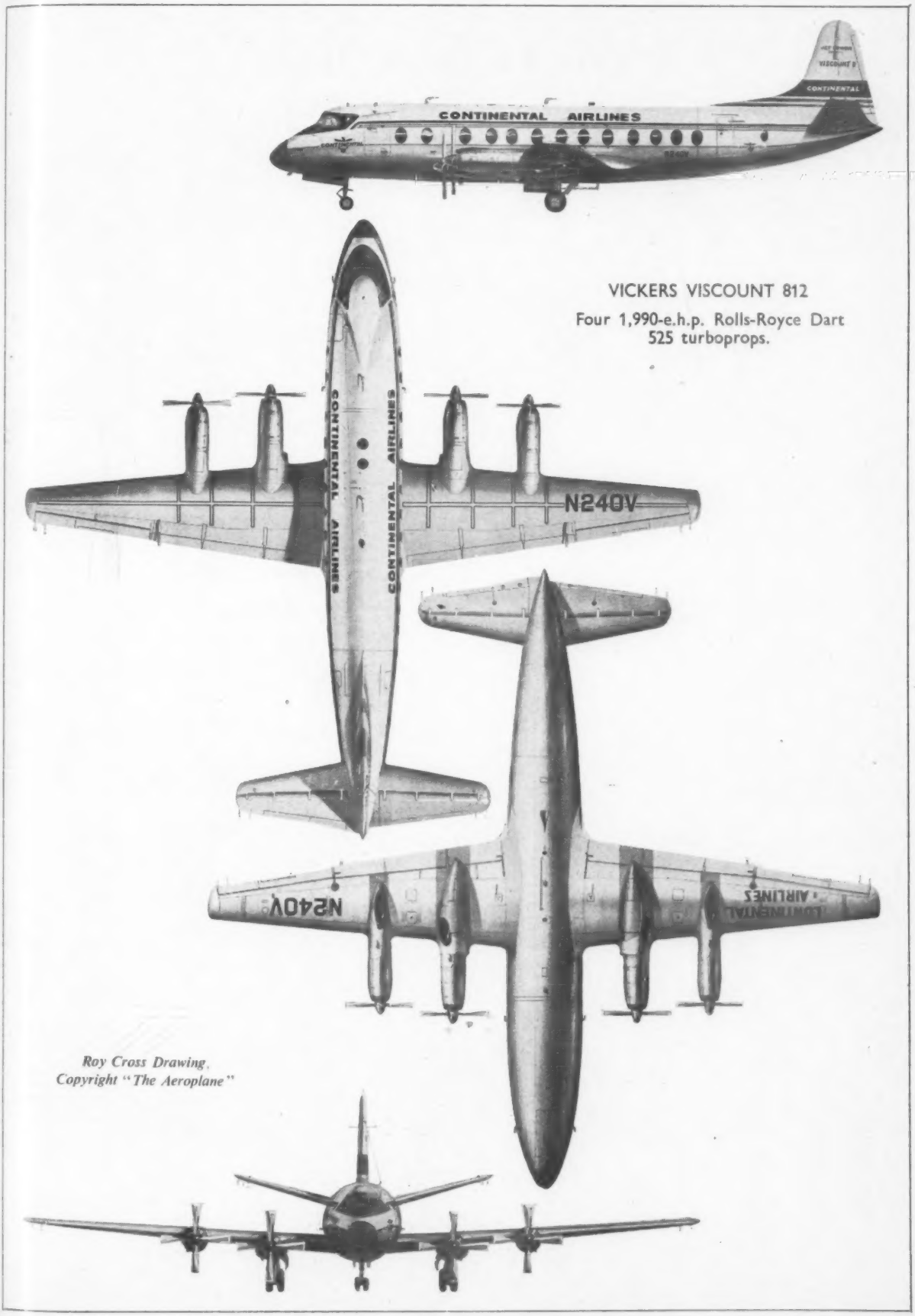
The first Viscount 810, which is Vickers' own test vehicle, first flew last December and has since played a substantial part in obtaining a full American C. of A. for the 812 for Continental Airlines. During the course of this, the aircraft was certificated above its original design weights as follows:—

	Certification.		Design.
Max. T.O. weight	69,000 lb.	..	67,500 lb.
Max. L.W.	62,000 lb.	..	60,000 lb.
Max. Z.F.W.	57,500 lb.	..	54,500 lb.

The weight of 69,000 lb. had originally been the target for the Viscount 840 with R.Da.11 engines. It now seems certain that this latter variant will be cleared, by 1960, for a weight of not less than 70,000 lb., or exactly twice that of the original V.C.2 project 14 years ago.



The cockpit of the Viscount 812, one of the six or so basic layouts developed for the Viscount. This is designed for two-crew operation. The weather radar display is prominent in the centre.



VICKERS VISCOUNT 812

Four 1,990-e.h.p. Rolls-Royce Dart 525 turboprops.

Roy Cross Drawing.
Copyright "The Aeroplane"

The Viscount Men

Viscount's Tenth Anniversary . . . .

Viscount Synthetic Training

SINCE the first Viscount flight simulator went into service with British European Airways in September, 1955, a number of the principal airlines operating Viscounts are now employing simulators and type trainers in their pilot-training and conversion programmes. Used for a wide range of captain and co-pilot checks and instrument-rating renewals, these equipments are now in operation with, or ordered by, Capital Airlines, Trans-Canada Air Lines, South African Airways, Lufthansa and K.L.M. Royal Dutch Airlines.

Developed from the relatively simple instrument procedure trainers produced for military aircrew instruction during the 1939-45 War, the present-day equipments are, apart from the general-purpose procedure trainers, designed around the cockpit and performance characteristics of the aircraft they represent. Both full-scale copies, the main differences between the flight simulator and the type trainer are in the degree of accuracy that they give relative to the flight characteristics of the particular aircraft, and the amount of equipment detail incorporated in the cockpit.

The simulator has a cockpit which is an exact replica of the actual aircraft, and its operating performance and flying control loadings are, to within certain limits, identical with those of the aircraft for any given set of flight conditions. With this type of specification, the simulator is designed for aircrews to undertake periodic proficiency checks or conversion courses, and to familiarize themselves with the operating procedures and emergency drills applicable to the aircraft.

Type trainers, on the other hand, are rather less complicated and therefore cheaper, and though they incorporate a complete mock-up of the flight deck they have a number of dummy panels and a less representative loading pattern on the flying controls. Also suitable for complete training exercises including pre-flight checks, procedure and emergency drills, they are not generally employed for such tasks as instrument rating renewals, although recently their usage in this field is being seriously considered by certain civil aviation authorities.

Basically electronic and electro-mechanical devices normally operating without physical movement, simulators and type trainers are principally manufactured in this country by two companies—Air Trainers Link, Ltd., of Aylesbury, and the Flight Simulator Division of Redifon, Ltd., at Crawley, Sussex. All of the 700- and 800-series Viscount simulators operating in the world have been produced by these two companies.

Supplying the two B.E.A. simulators for the Viscount 701 and 802, three Viscount 724 type trainers for T.C.A. and one Viscount 744 model for Capital Airlines, Air Trainers Link, Ltd., employ electro-mechanical controls incorporating pneumatic or hydraulic systems. Redifon, Ltd., on the other hand, use principally electronics with some mechanical loadings in the construction of their Viscount-type trainers for K.L.M. and S.A.A. and simulators for Lufthansa.

At present, synthetic trainers produced in this country are "blind" and can therefore be used only for normal instrument and route-flying training, but the possibility of visual simulation for landing training is being investigated. The sort of presentation in mind is a continuous-film picture of the final approach from, say, a height of 1,200 ft. (ILS outer marker position) to touch down on the end of the runway. The picture would have to move vertically and horizontally within the limits of a normal ILS approach.

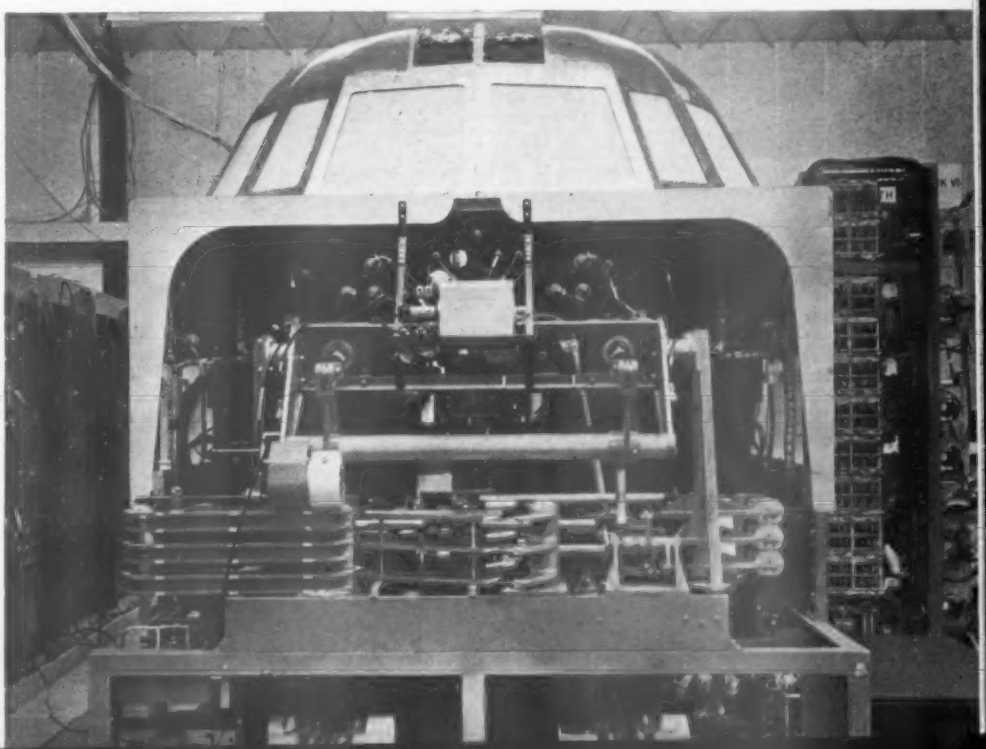
Another feature being considered for simulators, which is only applied to certain type trainers at present, is physical movement in pitch and bank, but not in rotation. The future B.E.A. Comet 4 and Vanguard simulators will have this limited motion device incorporated.

Route and Instrument Flying

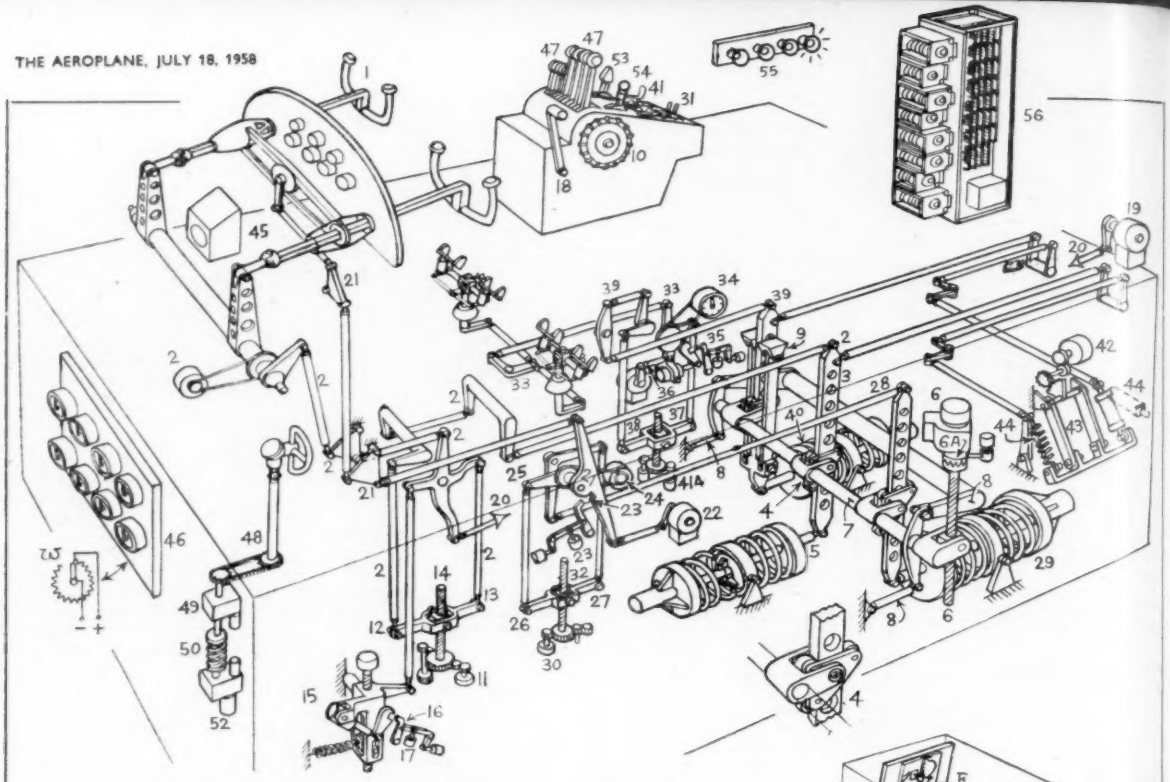
Apart from type conversions and aircraft operation procedure training, the most important use of simulators is in instrument flying and navigational aids instruction. For this rôle a radio-aids unit is supplied with the simulator for providing the necessary facilities and aids, together with a chart-and-pen recorder for tracing the aircraft's flight track.

Any automatic radio aid can be incorporated, but the standard Redifon installation includes ILS, Radio Range, VOR and ADF. The individual aids as required for an exercise are preset by the instructor, who also acts as air traffic control officer, and can be located in any position within the confines of the appropriate chart recorders.

In addition to the radio-aids unit, an instructor's panel is normally fitted behind the simulator cockpit. On this are repeaters of certain flight instruments; calibrated controls for setting up a number of flight conditions, such as aircraft C.G. position, fuel contents on take-off, sea-level barometer changes and icing effects, and a faults panel. The latter is used to



The nose section of the South African Airways Viscount 813 type trainer showing the control loading system. Built by Redifon Ltd., it is now being delivered to the airline.



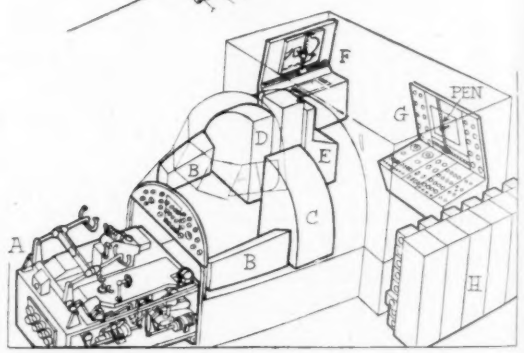
THE REDIFON SYSTEM

Elevator, aircraft climbing: Push stick (1) to level off, operates potentiometer (2) to record act back to computer and via 2 on to lever (3) with its fulcrum at the moment at 4, and so to double-acting spring-loaded plunger (5) to provide stiffness (air loading on flying surface). Change of air loading due to levelling out is noticed by computer which operates motor and screw jack (6) (with safety clutch (6A)) to raise shaft (7) vertically. Raising (7) raises pivots (4) to increase effect of spring loading (5) on rudder, elevator, aileron. Support-rod and hinge (9) simply supports gears in space.

Elevator hand-trim: Cockpit wheel (10) to computer to energize motor (11) and raise point (12) about the (at present) fixed point (13) by screwjack (14) to move rods and lever (3) to take off spring loading at (5). Elevator spring drive (15) with gust lock (16) operating solenoid (17) energized from lever (18) in cockpit. Autopilot motor (19) comes into the system at 20. Aileron, via 21 (with autopilot motor (22) and gust lock (23)) to potentiometer (24), extension 25, 26, 27 and 28, to spring loading 29 (air loading). Aileron hand-trim: motor (30) energized from cockpit (31) to drive screwjack (32) to move (27) about (26) to take off spring load at (29).

Rudder: via 33 to potentiometer (34), with gust lock (35) operated from (18) and autopilot servo motor coming in at (36). Extension (37) (38) (39) to spring loading (40). Rudder hand-trim: control 41 thence to computer to energize motor 41A to operate screwjack to raise point (38) about 37 to take off load at 40. Servo tabs: rudder and elevator tabs lose their bite at low air speeds, so motor (42) energized from computer, swings beams (43) down to reduce effect of spring loading (44) with height.

In General: 45, loudspeaker aerodynamic noise; 46, potentiometers for throttles and H.P. fuel cocks (47); 48, nosewheel steering drive to control end gearbox (49) which includes direction-sensing switch, load spring (50); end gearbox following control-end and servo motor (52); 53, flap control, thence via microswitches (for flap positions) to computer; 54, propeller fine pitch disengage/engage lever (from throttles (47) to potentiometer (46) thence to computer. Computer back to (54) and to lamps (55) which go out at +23° propeller pitch); 56, computer unit.



Drawing key: A, control unit (slides into cockpit); B, aircraft instrument console; C, aircraft port radio rack; D, aircraft starboard radio rack used as fault panel; E, instructor's desk; F, console with small-scale general map; G, console with large-scale map of the immediate locality; H, computers.

simulate faults and abnormalities in airframes, powerplants, electrical and other systems.

As a result of general airline experience it has been determined that the average exercise should be planned to last for approximately 2 to 2¼ hr., regardless of whether it is an advanced exercise or *ab initio* training. The actual time of the exercise, however, is not normally arbitrarily fixed for this period, as efficient crews may complete all aspects of the training programme sooner. Time allowance is only a governing factor in the exercise, which is basically planned to cover the necessary range of checks and procedures required for training.

The general pattern adopted for this type of synthetic training is for a captain or co-pilot to complete two such training periods in one day, with a break of similar length (2¼ hr.) between the two exercises. In this way, a number of crews can receive instruction at the same time with a well-organized programme covering briefings, simulator flying and rest periods.

B.E.A. Viscount Simulators

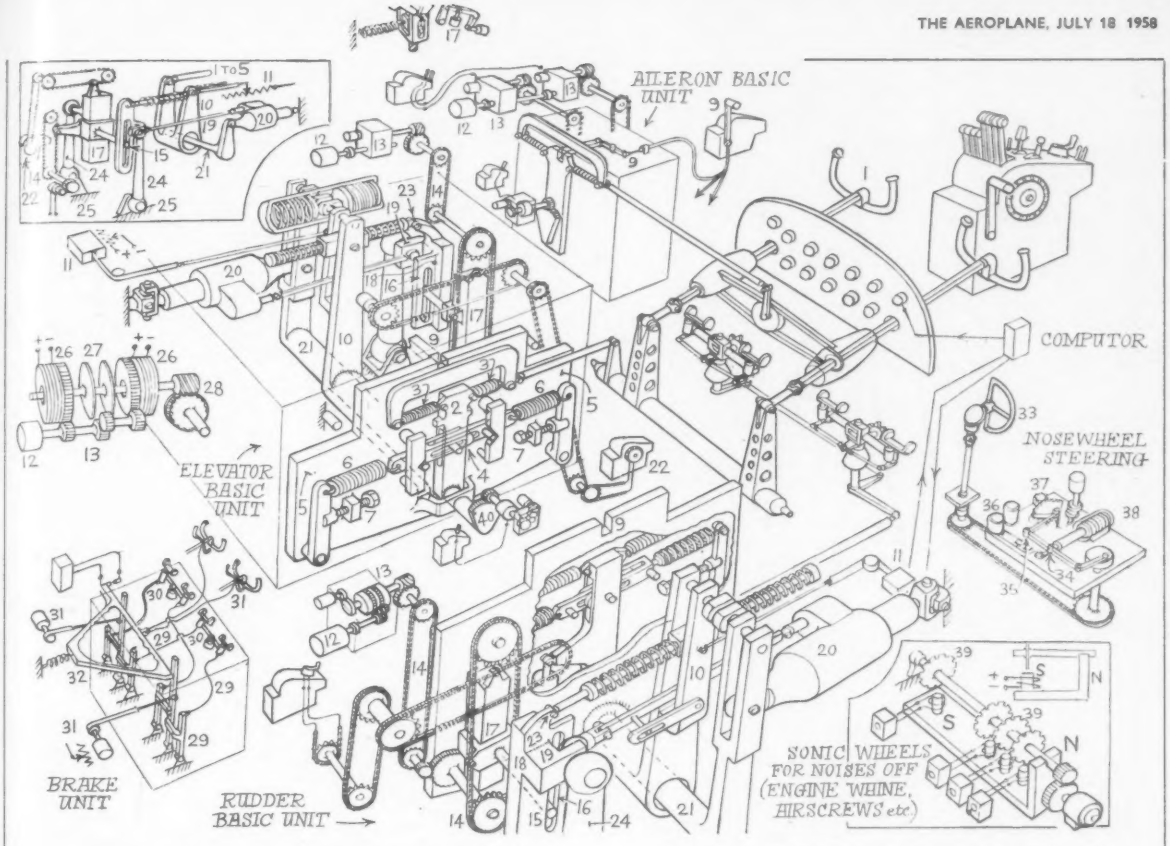
The first simulator of Air Trainers Link, Ltd., for the Viscount 701s of B.E.A. was originally installed at the company's Training Unit at Northolt, but in June, 1957, the Simulator Section was transferred to its own self-contained establishment at Heston. Here the 701 simulator became operational in September, 1957, together with the later Viscount 802 equipment and the Elizabethan simulator.

Basically similar, the two Viscount units are housed in separate rooms with a common computer room running alongside. Both have DC analogue computers and the main differences are in cockpit instrumentation, radio aids and powerplants, and operating limitations.

Employed by B.E.A. on captains' bi-annual refreshers; captains' and co-pilots' instrument-rating annual renewal tests; type conversions, and co-pilot refresher training, the Viscount 701 simulator is also used for general pilot training by other airlines operating Viscounts. Before its introduction an average of 4,000-6,000 flying-training hours was undertaken by B.E.A. to meet its training requirements. This involved the withdrawal of aircraft from revenue earning, and it has been found that the simulator has cut the use of aircraft in Viscount conversion by half; in general 2 hr. in the simulator are equal to 1 hr. in an aircraft.

The unit consists of a nose-section containing a replica of the Viscount 701 flight deck, behind which is the instructor's position with the "trouble" panel. Aft of the instructor's

(*Continued on page* 107)



THE AIR TRAINERS SYSTEM

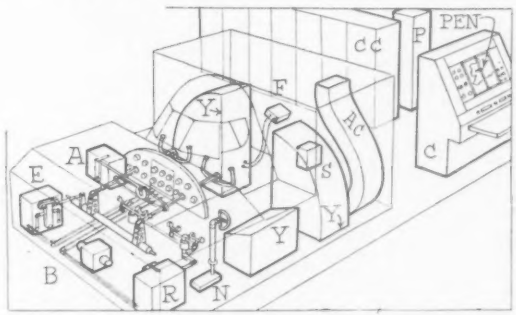
Elevator, aircraft climbing: Push stick (1) to level off, pushes 2 via springs (3) and links (4) and -pulls/pushes (5) through springs (6) and ultimate stops (7) (rudder and elevator spring drives) to rock plate after you have released gust lock (9) and swing arm (10) fixed to it. Arm (10) will cut out some resistance of potentiometer (11) metering back to computer. The effect of levelling-out changed rate of climb, height, engine revs., jet pipe temperature, and so on, all which the computer will message back to instrument board. Levelling-out also increased air loading on elevator, rudder and aileron surfaces because of increased air speed.

Computer notices this and sends current to motor (12) after setting magnetic gearbox (13) in right rotation. Drive (14) will send pin (15) up slot (16) by carriage and track (17). Now the lever (18) hinges about pin (15) so movement of 10 (from stick) will move link (19) less than before. Link (19) works the follow-up valve of Fairey jack (20) fixed to shaft (21) fixed solid to plate (5). Move 10 and you twist 21 if jack (20) is not in step with control. Moving pin (15) up slot (16) gives relatively greater and greater movement between 10 and 20 until 15 is at max. position, in line with pin (19) when jack will not move at all.

Hand-trim to trim out loadings: Move cockpit pedestal wheel (22) to move carriage (17) fore or aft, and pin (15) with it to rock lever (18) about the at-present fixed point 23 (stick (1) and lever (10)). Link (19) moves, and jack (20) moves to unwind the twist in 21 induced by air loading or indeed by other causes such as nose heaviness. Link (24) hinged at base (25) simply suspends mechanism in space.

In general: Aileron has no hand trim but two switches 12/13, and no spring drive (6). Gearbox (13) comprises coils (26) toothed up to motor in opposite rotations. Excite either coil to attract and hold its plate (27) and turn gear (28) in that particular direction. Foot-brake action of the stronger man (29) moves that pedal over (30) to operate potentiometers (31). Hand brake with its stronger man (31) overrides all at (32).

Nosewheel steering wheel (33) moves point (34) down about pivot (35) to set potentiometer (36) to meter back to computer which signals motor and pinion (37) to drive quadrant and point (35) to bring point (34) to original position. 38 is double-acting spring-loaded plunger. Sonic wheels (39) interrupt the flux from N to S to make the sound of engines and so on. Auto-pilot servo-drives to elevator, rudder, aileron is by motor and quadrant (40) on to 5.



Drawing key: A, E, R, basic units for aileron, elevator, rudder; B, brake unit; N, nosewheel unit; S, sonics amplifier; F, plug-in fault box; C, console; P, hydraulics cabinet; CC, computor; AC, air-condition up to cockpit; Y, aircraft instrument side panels and port and starboard radio racks.

(*Continued from page* 106)

panel is a rack containing automatic recorders of ILS and GCA performance together with tape records of R/T clutter, and the console-operator's station embodying controls for setting up the variety of simulated ground aids for radio navigation by reference to a ground-track chart recorder.

In or under the extreme nose of the flight deck is the equipment for applying to the main flight controls forces simulating the air loads experienced in flight. Essentially this consists of double-acting compressed-air springs in which the level of air pressure is automatically varied in accordance with computed airspeed, and is elaborated to provide for adjusting no-load settings with the aircraft trim-tab controls.

Automatic radio aids incorporated in the 701 unit include ILS, ADF, radio range and marker beacons, and Sperry zero reader. In the Viscount 802 simulator the zero reader is replaced by the Smiths integrated flight instrument system.

During last year, when only nine months' operational use was obtained because of the move from Northolt to Heston, the 701 simulator logged 2,027 training hours with an unserviceability factor of 3%. Of this total 1,345 hr. were spent on conversion instruction and 400 hr. went to other airlines for general pilot training.

The scope of the B.E.A. Viscount 802 simulator is limited in operation to the London flight area and has a maximum altitude restriction of 8,000 ft. It therefore cannot be employed on route flying, although all other types of exercises, including 701/802 "differences" courses, can be undertaken. The pneumatic system for simulating flying control loads in the 701 has been replaced by hydraulics.

In the first six months of its operation (September, 1957, to

Viscount's Tenth Anniversary . . . .

The Redifon Viscount 813 type trainer for K.L.M. at Schiphol Airport. To date, it has been in operation for over 1,500 hr. on type conversion and general pilot training.

March, 1958) the 802 simulator has been used for 1,064 hr. of training, with an unserviceability time of 3¼%. Again, of this total 760 hr. were employed on captain and co-pilot type conversion, which included 701/802 differences courses and other types to Viscount instruction.

Redifon Equipment

From its wartime activities of producing synthetic pilot and navigator trainers for the R.A.F., Redifon, Ltd., has developed and manufactured an increasing range of procedure trainers, type trainers and full simulators. Starting with the B.O.A.C. Stratocruiser and Comet 1, the company has built a number of Valiant simulators for Bomber Command, the first of which went into service in 1955, a Victor simulator, and several other units including a Comet 2 installation, before producing its first Viscount equipment.

This was the Viscount 803 type trainer for K.L.M. in 1957, and it is now operated by the airline's Training Unit in Amsterdam. The other Redifon Viscount equipments are the 813 type trainer for S.A.A., now being delivered, and the Lufthansa Viscount 814D simulator which is under construction at Crawley.

As the latest of the series, the Lufthansa simulator is based on the first production Viscount 814D fitted with Rolls-Royce Dart R.Da.7/1 turboprops. It comprises a fixed-base facsimile of the flight deck, instructor's consoles, track recorders and rack-mounted electro-mechanical computing equipment, control-loading mechanisms and self-contained power supply.

Suitable for the types of periodic checks, navigational exercises and conversion courses previously mentioned, the simulator has the flight-instructor's station aft of the co-pilot's position. A radio aids and navigation instructor's compartment is provided at the rear of the fuselage section, and its equipment includes one large-area track recorder covering an area of approximately 1,000 by 1,000 miles; one local-area track recorder (125 by 125 miles); two radio aids and fault-simulation controls, and cockpit instrument repeaters.

The simulator performance covers all aspects of the aircraft operation from crew entry to de-briefing, including pre-flight checks and taxi-ing. Engine-out operation is simulated, including asymmetric flight, wet starts, and airborne feathering and relights on any engine. With a throttle setting of 14,000 r.p.m. and above, auto-feathering results in the normal way from engine failure at take-off.

Radio aids in the 814D simulator include two radio ranges with adjustable-range legs; ADF beacons and locators; VOR; ILS and GCA. This equipment when set by the instructor is fully automatic and needs no further action by him except re-siting when necessary.

Recorder units consist of a gantry-mounted pen which automatically records the ground track of an exercise, and the approach recorders, designed to show simultaneously the angle of descent, heading and speed achieved by the pilot during the approach.

Simulators have been described as "habit-forming machines of an advanced type," and a good-habit pattern can be produced by a good simulator.

To produce and maintain a high standard of simulation first-rate instructors capable of imparting as much "realism of actual conditions" as possible, without which the exercises will lose much of their usefulness, are required, plus maintenance crews who not only keep the equipment operating efficiently, but learn to appreciate something of actual flying conditions, which is of great value when adjusting any faults that may arise in the training devices.—P.R.R.

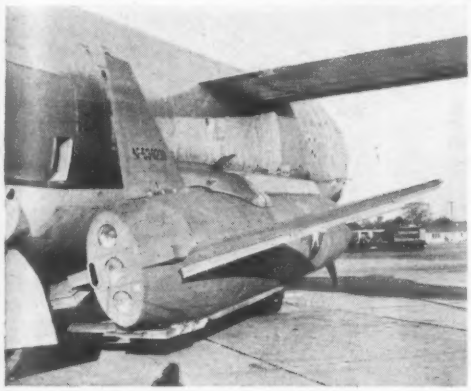
Above, the console operator's position of the B.E.A. Viscount 802 simulator. This unit is limited in operation to the London flight area and [a maximum altitude of 8,000 ft.

Left, cockpit layout and instrumentation in the Air Trainers Link Ltd., Viscount 802 simulator operated by B.E.A. The equipment is installed at the airlines Simulator Section at Heston.

New World Photo-News

Pictures by Howard Levy

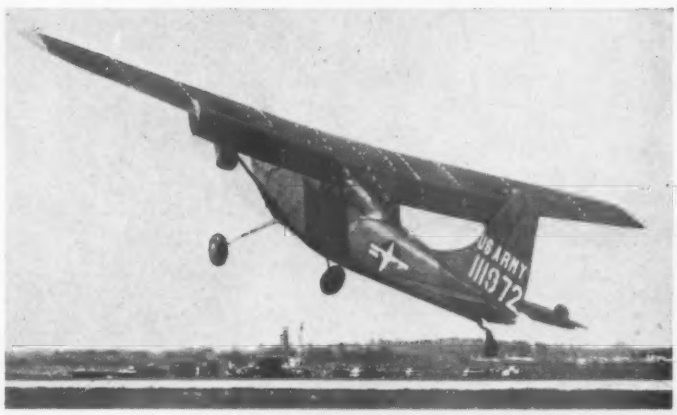
Above, seen at Houston International Airport is the second Lockheed Jetstar eight-seat executive aircraft, which is powered by two Bristol Orpheus turbojets.



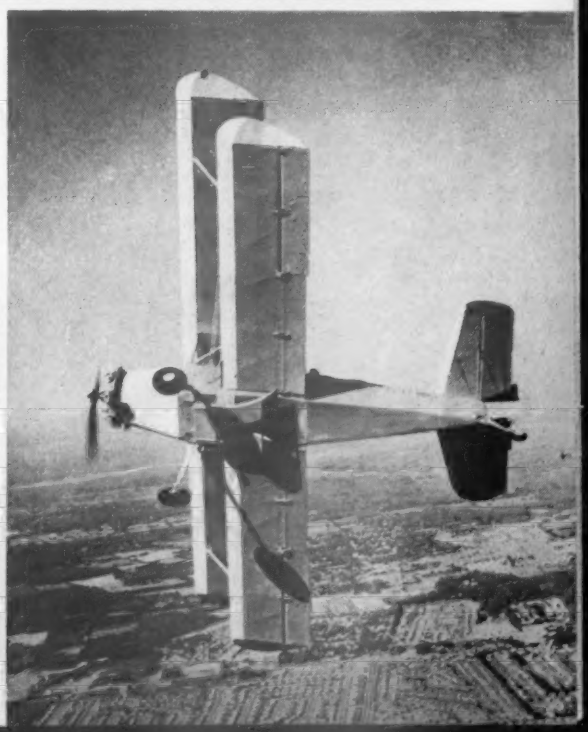
Above, a close-up of a Bell Rascal air-to-ground missile carried under a Boeing DB-47 Stratojet. Rascal is powered by three liquid-propellant rocket engines.

Below, a mock-up of the Grumman YAO-1 observation aircraft showing the turbine exhaust in the engine nacelle, the air brakes in the fuselage and the large-area flaps.

Below, this Cessna L-19 Bird Dog has been modified by the Aerophysics Department of the Mississippi State College for boundary-layer control experiments using area suction through the porous upper surface of the wing and flap. Suction is supplied by a 9-in. dia. turbo-fan in each wing driven by Vickers hydraulic pumps. The aircraft stalls at 32 m.p.h. at a weight of 2,300 lb. and can take off in 150 yd.



Grumman's Ag-Cat agricultural biplane, showing (right) the dusting hopper under the fuselage and (below) fitted with streamlined pump unit and both leading-edge and trailing-edge spray nozzles.



Comets from Chester

ALL TOO OFTEN one tends to think only of the parent factory of any given aircraft company and to regard any other production units as but satellites to the centre of the system. In the case of the de Havilland factory at Chester this view would be a gross error, and we recently visited it to discover the extent and nature of the work undertaken—now largely concerned with the Comet 4.

The first view a visitor has of the factory is most likely to be an aerial one from a de Havilland inter-factory service Dove or Heron. This airborne introduction gives a slight shock to the first-time visitor because the area covered by buildings is considerable: the main production hall covers nearly a million sq. ft. It is, in fact, the main aircraft production unit of de Havillands.

Formerly a "shadow factory," the buildings at Broughton, near Chester, were leased to The de Havilland Aircraft Co., Ltd., in July, 1948, by the Ministry of Supply so that an increasing number of aircraft for export could be built by the enterprise. As an example of the high rates of production achieved, some 3,400 aircraft were built between the spring of 1951 and the end of 1956.

At first, the factory produced Mosquito and Hornet aeroplanes. Before the end of 1949 Vampires built at Chester had been delivered to Sweden and Switzerland. The Canadian-designed Chipmunk was put into production in 1950. During that year aircraft were built at the rate of one a day with a bonus of two at the end of it. Of this total 151 were Vampires.

The Dove light transport started coming off the line early in 1951, and 21 were built before the end of the year. The two-seat Vampire night fighter emerged in the autumn of 1951. The total of aircraft produced in 1951 was 683, including 340 Vampires.

In 1952 the first Venom fighters were made at Chester, the first flying in June. By October the Vampire Trainer had appeared. Later came the Sea Venom and the Heron four-engined transport. Work on the Comet 2 began in 1952 and, after stopping in 1954, was restarted in 1955 with modified aircraft for the R.A.F.

Some work on the Sea Vixen has been done, but production of this aeroplane is now concentrated at Christchurch, although a certain amount of work is done at the Portsmouth factory. A few Doves and Herons are still being turned out at Chester and on the occasion of our visit a batch of fuselages for Swedish Vampire Trainers was in the process of completion.

Almost the entire floor space and productive effort is now directed at speeding the production of Comet 4s, of which 14 are to be made at this Welsh factory (Broughton is just inside the border of Flintshire).

The production equipment and layout is almost identical with that at Hatfield. Apart from titanium welding and heavy wing machining, the factory is self-sufficient with Redux bonding shop, a large rubber press, six drop-hammers, and a plastics shop for glass-fibre and Perspex moulding.

In some ways the layout of equipment is more advantageous than at the parent concern, mainly because of the splendidly large assembly hall with its overhead crane system. The latter is used to move the complete Comet 4 wing from the wing-assembly line to mate with the completed fuselage.

The first Comet 4 is in an advanced stage of construction and is due to make its first flight in September. The second aircraft is not far behind and the whole vast assembly area is being rapidly filled with Comet components.

The accent at Chester is firmly on production personnel and much effort has been put into securing new workers. Interviewing teams have been sent to many northern towns (the south of England is the "hunting" preserve of the Hatfield factory) after a newspaper advertising campaign.

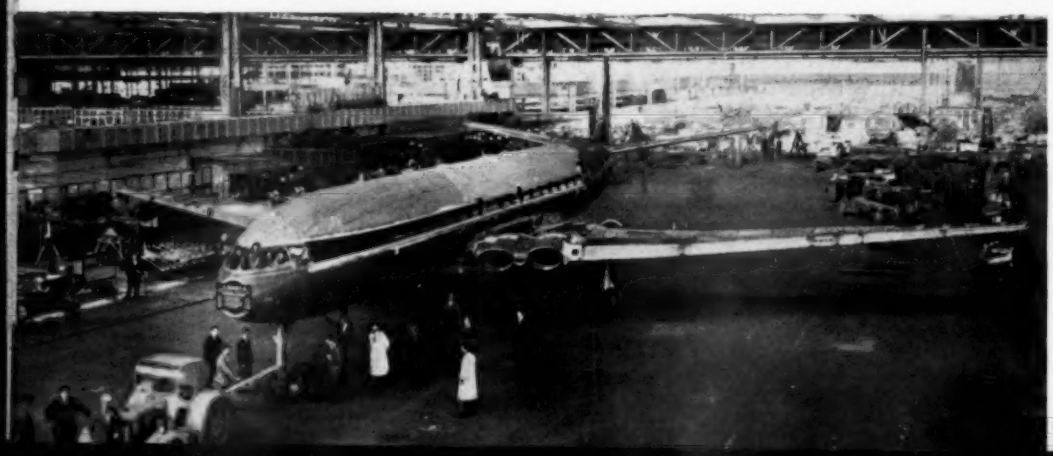
For those not already working in the aircraft industry there is a training scheme which lasts six months and has an intake of 20 trainees each month. Many of these are ex-National Service men who have acquired some engineering or mechanical experience in the Services. At present there are about 120 men under training, most of them local people.

PRESSING ON.—This large rubber press is used at Chester for producing rib webs and similar parts. There are also six drop-hammers in operation.

Numbers of special buses are run each day to collect and return people within a radius of 45 miles of the factory. About 850 people live between 10 and 20 miles away, 300 are 20 to 30 miles distant and 60 have their homes more than 30 miles off. The other 4,000 or so are within 10 miles of Broughton. As a matter of "national" interest, about half of the total actually live in Wales.

Training of apprentices has long been a feature of the establishment and a branch of the de Havilland Technical School was established at Chester in 1949. There are now about 400 apprentices under training. Intake is at the rate of 90 a year and the course is for five years.

There is a separate repair organization for R.A.F. Comets, and other military de Havilland aeroplanes. Servicing of Doves and Herons is shared with the Leavesden establishment of The de Havilland Aircraft Co., Ltd. Even the perennial Tiger Moth is part of the picture. Two of these (G-AMGC and G-ANTE) in bright red-and-yellow livery are the faithful servants of The de Havilland (Chester) Flying Club.—D.G.



CHESTER COMET.—Nearing the end of the final assembly line at the Chester factory of de Havillands is the first of 14 Comet 4s to be built there.

Dr. A. E. Slater

World Gliding Championships

The Czech Spartak sailplane. Lorne Welch (right) talking to the designer.

IT is 21 years since a German sailplane pilot won a full-scale international gliding contest. Now it has happened again, but in markedly different circumstances. In 1937, at the time of that first contest, the Germans were still very much the pioneers, and took five of the first six places in the final list. This time, on the other hand, during the International Gliding Championships held at Leszno in Poland from June 15 until June 29, a single German has reached the top against fierce competition by, especially, pilots from Great Britain, Czechoslovakia, Yugoslavia and Poland, all of which countries were represented in 1937, though among them only the Poles were serious challengers then.

A second change over the 21 years has been seen in sailplane design. Minimum sinking rate, for staying up over hills and catching thermals at low altitudes, used to be aimed for; but nowadays the most advanced sailplanes are designed primarily for fast, flat glides between thermals, and though a low sinking rate has been retained by the use of laminar-flow wings, the speed for achieving minimum sink is a good deal faster—e.g. about 50 m.p.h. in the Yugoslav Meteor compared with 28 to 35 m.p.h. in typical pre-war designs.

These changes in design criteria, though foreshadowed just before the War, have come about largely during the 10 years since the second international contest, held in Switzerland; and over the same period there has been an immense increase in the number of highly skilled sailplane pilots. But this general increase has included a particular feature which deserves to be regarded as a third major change: in the past few years a small group of the World's sailplane pilots has reached such a pitch of competence in using thermals for fast cross-country flying, that in good conditions it is the comparative performance of their sailplanes that decides the issue, rather than their relative skill, which is too near perfect to matter much. The stronger the thermals, the less time a pilot spends in them, and the greater is the proportion of total time available for gliding at high speed from one thermal to the next, which is just what these new machines are designed for.

As an example of fairly "good conditions," take the preliminary practice period at Leszno described in THE AEROPLANE for June 27, p.906. Taking average placings of the leading pilots in the Open Class during the three days for which exact results were issued, they came out in the following order: (1) Komac and (2) Saradic, each flying a Meteor; (3) Makula (Poland) with a Jaskolka Z, (4) Deane-Drummond with Olympia 419, (5) Barbera (France) with Breguet 901S, (6) Nicholas Goodhart with Skylark 3, (7) Gorzelak (Poland) with Jaskolka Z, (8) Haase (Germany) with HKS-3. The two Meteors, which have the heavy wing loading of 31.5 kg./sq. m. (6.45 lb./sq. ft.), were consequently regarded at this time as Britain's most serious rivals, rather than Haase, though the wing loading of his HKS-3 is 25.7 kg./sq. m. compared with 22.2 for the Skylark 3 and 21 for the Olympia 419, while the Breguet's figure is 28.

The very first contest day, Monday, June 16, belied any expectations based on the practice period. The task was an out-and-return race of 230 km. (143 miles) with the turning-point at Jelenia Gora, S.W. by S. This is the site of the famous "Moazagotl" cloud under which the first wave flights in history were made 25 years ago, and the only mountainous district to which pilots were sent, with a southerly wind too light to produce a "Moazagotl."

On this day the thermals, though good at Leszno, became weak 15 miles out as soon as the Oder valley was reached, and were nearly as poor at the turning-point. It was no day for Meteors; Saradic made the slowest time but two, and Komac even came to earth on the homeward leg. It was also worse for the 15-metre machines forming the Standard class, only five of which completed the course, than for the Open class with their aerodynamic advantage of larger span, of whom 16 got round.

Haase won the race at 55.4 km.p.h.; Deane-Drummond and Nicholas Goodhart tied for 9th place at 46.9 km.p.h., being beaten by two Breguets, two Jaskolkas, two Zugvogel 3s, and a Czechoslovak Demant, as well as Haase's HKS-3, which can change the camber of its wings in flight, though the mechanism for doing so is a great deal heavier than that of a bird. In the Standard class Witek of Poland won at 49.1 km.p.h.

In contrast to days of strong and plentiful thermals, when what matters is the high-speed performance of the sailplane and the skill of the pilot in getting directly into the core of each thermal without delay, weak or sparse thermals demand additional techniques. If they are distributed unevenly according to the landscape, skill is needed in knowing where to look for them; if they are infrequent, as they were this day around the turning-point, luck plays a large part; and if they are barely strong enough for keeping airborne, minimum sink of the machine is all-important (that of the Meteor is unknown), and often the type of variometer used.

The British pilots had a "secret weapon," the Cook electric variometer, whose details its inventor has not yet revealed. On this day Tony Deane-Drummond managed to save himself at Jelenia Gora when down to 300 ft. above ground, well below the mountain tops.

The second contest day followed the first immediately, on Tuesday, June 17, with a modest 100-km. triangular race, set because the organizers expected a strong wind to make the going difficult. But the wind was weaker than forecast; all the Standard class got round and all but four of the Open class. In spite of rather sparse thermals on the first and second legs, it was a Meteor day, for Komac finished 2nd and Saradic 4th; a suggested explanation was that such a refined machine, with a gliding ratio of about 42, has the advantage of being able to cross large gaps between thermals without much loss of height.

But Haase (gliding ratio 37.2) was again the winner, this time at 83.4 km.p.h., while Deane-Drummond (ratio about 38) did well in 3rd place with 76.8 km.p.h. Both Nicholas Goodhart and Daniel Barbera, each with a gliding ratio of 36, shared 14th place at 63.2 km.p.h.

Again, on Wednesday, June 18, another contest followed without a gap; it was a race to Warsaw, 196 miles E. by N., with a strong southerly cross-wind. Pilots had to get away rather quickly, as the sky at Leszno began filling up with castellatus cloud, the forerunner of thunder. Half of them

Left, three French sailplanes (front to back) Breguet 905 (standard class) with V-tail, Breguet 904 (2-seat) and a Breguet 901S.

Betsy Woodward photographs

came down at Gostyn, only 22 miles out, including Philip Wills; but this was a day on which luck played a part, for Deane-Drummond was down to 350 ft. above ground there, yet recovered and made the day's longest distance, landing 21 miles short of Warsaw, which nobody reached.

Haase landed 60 miles short of the goal, but the 778 points he earned—his lowest day's score—were just enough to keep him in the lead with 2,778 points for the three days, only 32 ahead of Deane-Drummond, whose total was 2,746. Nick Goodhart made 5th longest distance, followed by the Meteors, each with a kilometre less—they were learning the advantage of keeping together. Tandefelt of Finland made best distance in the Standard class, 156 miles, with Witek not far behind; Tony Goodhart made 131 miles and climbed from 8th to 6th place in the overall totals.

After a fine day during which many people were still trailing back along the Warsaw road, and two days of warm-front overcast, the fourth task was set on Sunday, June 22. It was a downwind race to Ostrow, 57 miles E. by N. Cumulus clouds predominated during flying hours, but there was cumulo-nimbus around as well, so that although many of the fastest competitors set off early under a cloud street, others waited around in the neighbourhood for the opportunity to climb to a great height in a cu-nim, in the hope of making the goal in a single fast glide—a more chancy method which would bring good reward if successful, but not everyone brought if off.

Juhani Horma, of Finland, in a PIK 3c, made the best of both methods: first, he climbed to 4,000 ft. in an ordinary cumulus, then went up to 7,500 ft. in a cu-nim and made a fast glide straight to the goal. This gave him the fastest time of the day, 1 hr. 3 min. 5 sec., beating even Haase to it by 30 seconds, and all the rest of the Open class as well.

Deane-Drummond, on the other hand, decided on the pure cu-nim technique, and as the first one took him only to 7,000 ft., not enough to glide all the way to the goal, he came back for a fresh start. Later, we heard over the radio that he was beginning his final glide-in, but the combined effect of a down-current and a change of wind brought him down 3¼ miles short. This was an unfortunate set-back, for he earned only 278 points for distance and sank from 2nd to 9th place.

On this fourth contest day at Leszno, Nick Goodhart finished 7th, and in the Standard class Tony Goodhart came 11th and Philip Wills 20th, while Persson of Sweden ousted Witek of Poland from the lead. Of the Meteor pilots Komac finished second to Haase, but Saradic came down half way there; chance certainly played a big part this day.

Incidentally, the three Russians in the Open class failed to reach the goal, whereas Viktor Gonczarenko, the only one in the Standard class, came fifth; it is rather remarkable that this pilot, who appeared to be the best of the Russian team, is not, as one expects competitors from Eastern Europe to be, a full-time gliding man, but sings professionally in Kiev State Opera House.

A few half-hearted claps greeted the announcement at briefing on Tuesday, June 24, of a "free distance" day, although many people had been clamouring for it. Perhaps the weather was too good, and so many pilots would be stopped by the Russian frontier—about 10 actually were—that no one would know how much farther they could have gone. Then there were the frustrations of long-distance telephoning.

A Meteor day, of course, with Saradic and Komac keeping company and tying for second place with 529 km. each; but Kumpost beat them with 536 km. (333 miles) in the new Czecho-slovak Spartak, whose wing loading has not been published yet. It was too terrific a day to go into much personal detail: in the Open class every pilot but four exceeded 300 km., and in the Standard class all but three. Of the total of 61 pilots in both classes, 36 exceeded 400 km., and 10 (including four in the Standard class) exceeded 500 km. Nicholas Goodhart tied with Haase and Kuntz of Germany for 4th place with 514 km. but they were beaten by three Standard class pilots: Horma (Finland), Opitz (Hungary) and Silesmo (Sweden).

No more contest days were destined to be held after the sixth on Thursday, June 26, though no one knew it at the time. The task was distance along a line north-east through Inowro-claw, the place where, in 1937, the Poles held the first national contest to be organized on a flat site in any country.

This was the British team's outstanding day, for their pilots made the two longest distances in the Open class (Nicholas Goodhart 130 miles: Deane-Drummond 128 miles) and second and third in the Standard class, in which Heintz Huth, of Germany, led with 119 miles—the same distance as Haase, who easily kept his overall lead and became World Champion—a well-deserved win due to consistently good flying throughout. Nicholas Goodhart was his runner-up. Winner in the Standard class was Adam Witek of Poland, who was tipped for this position in THE AEROPLANE before the contest began.

A newly instituted OSTIV prize for "the most outstanding contribution to soaring flight" was awarded to Dr. Joachim Kuettner, and another for the machine in the Standard class which best fulfilled the objects for which it was instituted, to the German Ka-6BR.

Below, C. E. Wallington went with the British team as meteorologist. With him is Tony Goodhart (right).

Above, two Polish sail-planes, the Jaskolka Z and the Mucha Standard.

Right, a Hungarian entry, the Standard Futar.

Below, another Hungarian sailplane, the Siraly.

Betsy Woodward photographs

National Air Races

Photograph copyright "The Aeroplane"

Part of the large crowd at Coventry watching the CFS Jet Provost team.

Bad weather curtailed the last day's events at Coventry.

DESPITE heavy rain for much of Saturday, the flying programme got started roughly on time, when six members of the British Parachute Club dropped from Tiger Moths at 1,500 ft. for a spot-landing competition, an event won by Miss Sue Burges, who landed 42 ft. from the target.

As the rain continued a Hunting Jet Provost, XD694, was demonstrated by Flt. Lt. T. L. Frost, of Armstrong Siddeley Motors, whose inverted turns round the aerodrome were most effective. Sqn. Ldr. J. H. Lewis, of Antarctic flight fame, showed off the slow-flying qualities and short take-off and landing of the sole British-registered D.H.C. Otter; and in one of the few remaining R.A.F. Spitfires—a Mk.16, TE476, from the Battle of Britain Flight at Martlesham Heath—Sqn. Ldr. Ives put up a sonorific show which he managed to make spectacular despite an incomprehensible restriction of aerobatting this aircraft.

After the aerobatic finalists had flown (as described later), an all-white Vickers Valiant, XD859, of No. 214 Squadron, Marham (pilot, Flt. Lt. B. H. Fern), came in fast and low, and then made a slow circuit with undercarriage and flaps extended.

Immediately afterwards nine Gloster Javelins drawn from Nos. 23 and 41 Squadrons flew over in tight formation; the Spitfire and Jet Provost flew again, and M. Cerny flew a Super Aero 45 four-seat Czech touring aircraft.

The last event before the King's Cup was the Topp Team of No. 111 Squadron's all-black Hawker Hunters. They appeared first in a tight "big nine" (see last week's issue of THE AEROPLANE). It was to be regretted that the cloud base (sometimes down to about 300 ft.) was not just that much higher to allow them to make their nine-aircraft loop and roll, which never fail to impress public and professional observers.

The display was resumed, after the King's Cup race, when some Army parachutists dropped from a tethered balloon; the four red-and-white Jet Provosts of the C.F.S. (led by Flt. Lt. N. Giffin, the others being Flt. Lts. D. McClen, F. Packer and P. Millington) put up a show which, while lacking the speed of the Hunters, lost nothing in tightness of formation.

Flt. Lt. Robin Holloway, winner of the Wright Jubilee Trophy this year, beat up the place in precise form in a C.F.S. Vampire T.11, and before the Lord Mayor of Coventry, Ald. H. H. K. Winslow, presented the prizes, the final item was a three-aircraft tied-together formation by the Tiger Club.

The Class Races

The first round of each of the class races—for the Kemsley, Osram and Goodyear trophies—were flown as scheduled on Thursday; the second and third rounds took place on Friday afternoon, having been delayed by ground mist.

The handicappers seemed to have more trouble this year in assessing the speeds of the aircraft than in the past, and although a good finish was achieved in Round I of the Kemsley race—there being 3 sec. between second and third, the 12th aircraft to finish was 1 min. 7 sec. behind the winner.

An unfortunate withdrawal from this race was Fred Dunkerley's Sparrowjet, in which he won the King's Cup last year, through the grounding of the Turboméca Palas turbojets.

In Round II, 72 sec. separated the first and last to finish; in Round III, 47 sec.

In Class II (Osram), nearly 3 min. were between first and last in Round I; 3½ min. elapsed between N. Jones' Turbulent and

CLASS I. KEMSLEY CHALLENGE TROPHY—Four laps of 11-mile Course

No., Pilot and Aircraft	Round I				Round II				Round III			
	Starting time	Net flying time	Speed	Place	Starting time	Net flying time	Speed	Place	Starting time	Net flying time	Speed	Place
	min. sec.	min. sec.	m.p.h.		min. sec.	min. sec.	m.p.h.		min. sec.	min. sec.	m.p.h.	
10 J. E. G. Appleyard, Chilton D.W.1a, G-AFSV	00 00	19 44.0	141¼	6	00 21	18 51.4	148¼	1	01 03	18 47.4	148¾	1
39 H. B. Iles, Miles M.18.II. G-AHKY	00 00	20 15.8	137¾	11	00 00	20 05.4	138¾	11	00 00	20 06.0	139	8
63 Wg. Cdr. R. H. McIntosh, Proctor 3, G-AEOJ	00 39	26 30.2	105¼	13	00 44	18 44.2	149	2	01 03	18 49.2	148¾	2 tie
64 A. J. Spiller, Proctor 3, G-AHFK	00 23	19 46.8	141¼	9	00 29	19 33.4	142¾	10	00 36	19 37.0	142¼	12
65 A. S. K. Paine, Proctor 1, G-AHNA	02 08	18 21.6	152	12	02 07	18 17.4	153	13	02 11	18 26.0	151¼	13
66 T. G. Knox, Proctor 3, G-AIHD	00 47	18 56.6	147¼	5	00 53	18 37.6	150	4	01 25	18 40.0	149¼	7
68 A. Barker, Proctor 3, G-ALFX	01 27	18 10.0	153¾	3	01 30	18 11.0	153¼	6	01 37	18 15.2	153	2 tie
80 P. Blamire, Gemini 1a, G-ALZG	02 54	16 28.8	169¾	1	03 06	16 22.6	170¾	3	03 32	16 20.6	170¾	4
85 E. Crabtree, Gemini 3c, G-AKEG	03 18	16 32.2	168¾	7	03 24	16 43.0	167	12	03 37	16 35.2	168¼	11
92 G. Marler, Falcon-Six, G-ADTD	03 26	16 30.8	169¼	8	03 29	16 26.8	169¾	8	03 39	16 33.0	168¾	10
94 F. Dunkerley, Gemini 1a. G-AKKB	02 27	17 07.6	163¼	2	02 42	17 10.8	162¼	7	02 51	17 16.6	161¾	9
96 R. R. Paine, Hawk Speed-Six, G-ADGP	04 41	14 57.8	186¾	4	04 44	14 54.8	187¼	5	05 02	15 00.2	186¾	5
97 P. S. Clifford, Mew Gull G-AEXF	06 13	13 59.0	199¾	10	06 19	13 40.4	204¼	9	06 22	13 40.6	204	6
98 F. Dunkerley, Sparrowjet G-ADNL	*Withdrawn*											

CLASS II. OSRAM CUP—Three laps of 11-mile Course

No., Pilot and Aircraft	Round I				Round II				Round III			
	Starting time	Net flying time	Speed m.p.h.	Place	Starting time	Net flying time	Speed m.p.h.	Place	Starting time	Net flying time	Speed m.p.h.	Place
	min. sec.	min. sec.			min. sec.	min. sec.			min. sec.	min. sec.		
4 B. Maile, Aeronca Champion, G-AOEH	01 12	24 14.6	87¼	11	00 59	23 56.0	88¼	11	00 31	24 02.4	87¾	11
6 D. Westoby, Auster V JI, G-AIPV	04 03	20 10.2	104¼	8	03 58	19 21.6	109	3	04 17	19 18.0	109¼	7
7 N. H. Jones, Turbulent, G-APIZ	00 08	25 52.8	81¼	12	00 00	25 14.4	83¾	12	00 00	25 50.4	81¼	12
8 G. F. Hancock, Turbulent, G-APBZ	00 00	23 37.8	89¼	6	00 00	23 39.4	89¼	8	00 00	23 32.2	89¾	5
9 K. B. Neely, Auster V, G-AKTF	*Withdrawn*											
15 C. E. Elton, Hornet Moth, G-AEWY	05 13	19 00.6	111	9	05 08	19 04.6	110¼	10	04 50	19 00.0	111	10
19 C. A. Nepean Bishop, Tiger Moth, G-APDZ	06 00	17 30.2	120¼	4	06 03	17 31.2	120¼	7	05 59	17 34.4	120	6
40 J. Heaton, Jackaroo, G-AOIR	02 37	20 29.4	103	1	02 49	20 16.4	104¼	2	03 07	20 24.0	103¼	4
41 D. F. Ogilvy, Comper Swift, G-ABUS	07 00	16 31.0	127¾	5	07 02	16 30.4	127¾	5	07 12	16 30.4	127¾	9
42 D. Hartas, Jackaroo, G-ANZT	02 31	20 59.0	100¾	3	02 33	20 47.0	101¼	4	02 38	20 58.8	100¼	8
43 W. H. Bailey, Hawk-Trainer 3, G-AKPF	06 21	17 23.2	121¼	7	06 23	17 27.2	121	9	06 24	16 53.6	125	2
44 W. P. Bowles, Monarch, G-AIDE	07 55	15 29.4	136¼	2	07 58	15 35.0	135¼	6	08 02	15 26.6	136¼	3
46 J. Hill, Belfair, G-AFJR	02 12	22 10.2	95¼	10	02 07	19 32.0	108	1	04 00	19 13.4	109¼	1
48 C. E. Elton, Active, G-ABVE	*Withdrawn*											

CLASS III. GOODYEAR CHALLENGE TROPHY (for D.H. Tiger Moths)—Three laps of 11-mile Course

No., Pilot and Aircraft	Round I				Round II				Round III			
	Starting time	Net flying time	Speed	Place	Starting time	Net flying time	Speed	Place	Starting time	Net flying time	Speed	Place
	min. sec.	min. sec.	m.p.h.		min. sec.	min. sec.	m.p.h.		min. sec.	min. sec.	m.p.h.	
14 W. V. Fitzmaurice, G-AOAA	00 53	20 05.2	105¼	9	00 51	20 08.4	105	11	00 30	20 10.4	104¾	11
16 G. T. Francis, G-AOXJ	01 23	19 34.8	107¾	8	01 20	19 24.8	108¾	8	00 59	20 05.4	105½	14
17 J. H. Denyer, G-AIVW	02 41	18 18.0	115½	10	02 35	18 11.8	116	9	02 10	18 11.8	116	8
18 J. Pothecary, G-APJP	01 03	19 29.4	108½	4	01 01	19 25.8	108½	6	00 50	19 28.8	108½	6
20 J. M. Donald, G-ANZU	00 39	19 42.8	107	3	00 40	19 44.6	106¾	5	00 32	20 03.8	105½	10
21 D. W. Phillips, G-ACDC	01 08	19 31.0	108	6	01 09	19 21.6	108¾	7	00 50	19 24.2	108¾	3
22 J. Piercy, G-ANZZ	01 29	20 13.4	104½	14	01 20	20 01.2	105½	14	00 50	20 04.6	105½	13
24 B. J. Snook, G-ANSH	01 14	19 28.4	108½	7	01 09	19 15.2	109½	4	00 55	19 19.0	109½	2
25 A. G. Oldham, G-AODR	02 23	18 37.0	113½	11	02 17	18 30.8	114	10	01 52	18 29.0	114½	7
26 C. Boddington, G-AOXS	01 29	19 58.6	105½	13	01 24	19 39.0	107½	12	00 50	19 41.6	107	9
28 J. A. Wardley, G-AHNI	00 53	20 32.0	102¾	12	00 51	20 20.6	103¾	13	00 30	20 20.0	103¾	12
30 W. P. Meynell, G-ANEL	00 11	20 07.0	105	1	00 00	20 13.0	104½	1	00 20	19 54.4	106½	4
31 H. A. G. Smith, G-AOXN	00 00	20 21.0	103½	2	00 00	20 17.0	104½	3	00 00	20 09.4	104¾	1
33 M. H. Reid, G-AOZB	00 17	20 19.8	103¾	5	00 30	19 46.8	106¾	2	00 30	19 46.8	106¾	5

Hill's winning Tipsy, which came in about ¼ min. ahead of the second aircraft in Round II. In Round III Hill came in first with N. Jones, again at the back, more than 2¾ min. later.

Between the first and last Tiger Moths in Round I of the Goodyear event there were 84 sec.; in Round II, 68 sec. Round III recorded an improvement with only a 55 sec. separation.

The tables published herewith are indicative of the general standards.

The King's Cup

This year's King's Cup win, by Jim Denyer—who also achieved that distinction in 1955—was perhaps the luckiest of any; lucky because he did not actually qualify for the event.

After gaining 42 points in the three rounds of the Goodyear race he was placed eighth—and only seven finishers were eligible to go forward to the big event. As it happened, J. Pothecary, who had qualified, was unable through another engagement to remain at Coventry—so Denyer was moved up.

Denyer had been getting 116 m.p.h. out of G-AIVW, the fastest of the Tigers entered, and he managed to push his speed up to 118.5 m.p.h. for the King's Cup. McIntosh, in Proctor G-AOEJ, increased his speed to 152 m.p.h. and crossed the line less than 3 sec. behind Denyer, with Bill Bailey's Hawk-Trainer a matter of 1.6 sec. later.

This race showed a notable improvement in the handicapping. The first eight aircraft were over the line within 10 sec., and with the exception of Blamire's Gemini and Hill's Tipsy (the last to finish being 68 sec. behind the winner) all aircraft were home within 28 sec.—which is very good handicapping.

Jim Denyer's Tiger had been completely cleaned up. All gaps were taped over with fabric; the slats and fuselage strakes were removed. Aluminium wing-root fillets were fitted, the rear cockpit was faired in; and even the pitot-head mounting was faired.

THE KING'S CUP AIR RACE, 1958—Four laps of 17-mile Course

No., Pilot and Aircraft	Starting Time	Net flying time	Speed	Place
	min. sec.	min. sec.	m.p.h.	
42 D. Hartas, Jackaroo, G-ANZT	00 00	40 50.0	102½	10
40 J. Heaton, Jackaroo, G-AOIR	00 57	39 51.0	105	6
31 H. A. G. Smith, Tiger Moth, G-AOXN	01 42	39 22.0	106½	18
30 W. P. Meynell, Tiger Moth, G-ANEL	02 03	39 03.8	107	19
20 J. M. Donald, Tiger Moth, G-ANZU	02 14	38 38.2	108½	12
33 M. H. Reid, Tiger Moth, G-AOZB	02 18	38 41.2	108½	14
24 B. J. Snook, Tiger Moth, G-ANSH	03 19	37 44.2	110¾	15
6 D. Westoby, Auster 5 II, G-AIPV	03 14	37 35.2	111½	9
21 D. W. Phillips, Tiger Moth, G-ACDC	03 14	37 49.6	110½	16
46 J. Hill, Belfair, G-AFJR	04 03	37 40.6	111	21
17 J. H. Denyer, Tiger Moth, G-AIVW	05 12	35 22.8	118½	1
19 C. A. Nepean Bishop, Tiger Moth, G-APDZ	06 26	34 17.0	121¾	4
43 W. H. Bailey, Hawk-Trainer 3, G-AKPF	07 59	32 38.6	128	3
44 W. P. Bowles, Monarch, G-AIDE	10 49	30 04.2	139	13
63 Wg. Cdr. R. H. McIntosh, Proctor 3, G-AEOJ	13 04	27 32.0	152	2
10 J. E. G. Appleyard, Chilton D.W.1a, G-AFSV	13 06	27 42.0	151	8
66 T. G. Knox, Proctor 3, G-AIHD	13 25	27 23.0	152¾	7
68 A. Barker, Proctor 3, G-ALFX	14 05	26 45.0	156½	11
94 F. Dunkerley, Gemini 1a., G-AKKB	15 52	25 11.8	166	17
80 P. Blamire, Gemini 1a., G-ALZG	16 41	25 00.0	167½	20
96 R. R. Paine, Hawk Speed-Six, G-ADGP	18 56	21 49.2	191½	5

Above, the King's Cup provided an extremely close finish, with Denyer's Tiger almost overtaken by McIntosh's Proctor at the post, and Bill Bailey's Hawk a close third.

Left, cleaned up to the virtual ultimate, J. H. Denyer's Tiger Moth achieved 118.5 m.p.h. in the King's Cup.

Below, among the winners at Coventry were (left to right), Bill Bailey, Jim Denyer, Wg. Cdr. McIntosh (third, first and second, King's Cup); R. Paine (S.B.A.C. Cup); P. Blamire and J. E. G. Appleyard (joint winners, Kemsley Trophy), and between them, Walter Bowles (Norton-Griffiths Trophy); J. Heaton (Osram Cup). The Air League, Norton-Griffiths and Grosvenor trophies were for the fastest average speeds in the Kemsley, Osram and Goodyear events respectively.

Photographs copyright "The Aeroplane"

Left, first, second and third in the Lockheed Aerobatic Competition were L. Biancotto (France), Z. Beseda (Czechoslovakia) and Chevalier d'Orgeix (France).

Below, this year, Biancotto used a Zlin Trener, which, with no height restrictions during the final demonstration, performed some very low aerobatics.

Photographs copyright "The Aeroplane"

Lockheed Aerobatics

FOR the first time since its inception, four years ago, the International Aerobatic Competition for the British Lockheed Trophy was awarded on the results of the eliminating round, because of unfavourable weather at the time of the final, and for the third time, L. Biancotto of France was judged the winner.

It would perhaps be more accurate to say that the decision to judge the contest on the preliminary round was made because of the particularly favourable conditions of a perfect summer evening on July 10, since the murk of early Saturday afternoon on July 12 did not prevent the seven finalists from presenting a superb, intimate and much more inspiring series of aerobatic performances.

The inflexibility of the rules, however, prevented these voluntary demonstrations from qualifying for adjudication, but they did offer an invaluable lesson in showing that aerobatics could be more, rather than less, of an art while being enhanced in general appeal by their compact and low-level presentation. Being timed from take-off to landing, instead of after a climb to height, the performances were much less drawn out than in the preliminaries and gave much greater scope to the pilots' skill and ingenuity.

Three more winners, P. Clifford (Air League Trophy); and H. A. G. Smith and W. P. Meynell (Goodyear Trophy).

There were several withdrawals before the start of the contest, which had the largest entry, of 19 pilots, to date. J. Blaha, and Prikryl, from Czechoslovakia, were unable to appear because of an impending display engagement in Moscow, while one of the Swiss contestants withdrew, and the recently rebuilt Arrow Active to be flown by some of the British entrants was *hors de combat* through a minor accident.

As it happened, none of the British pilots reached the finals, which indicates once again that a really aerobatic aeroplane must be made available in this country. The modified Bishop-Tiger Moth, G-APDZ, which appeared after our suggestions last year for improving the aerobatic capabilities of this veteran design, and has an inverted fuel and oil system as well as a cleaned-up airframe, offers some improvement but does not go far enough. It is still deficient in lateral and directional control for advanced aerobatics, although as Biancotto showed when he flew it unofficially at Coventry, it can be impressive enough in the hands of a master. The moral would also seem to be more practice for the British pilots.

Rarely seen at displays is the sole British registered D.H.C. Otter, G-AOYX, which was demonstrated at Coventry by Sqn. Ldr. John Lewis during the afternoon.

With one exception, G-APDZ was used by all the British contestants, and although it managed a few inverted manœuvres, such as bunts and outside turns, it did not lend itself to flick-rolls and other very rapid changes of direction. Hunting test pilot Barry Radley, in a Chipmunk, put up a very commendable show, and in an attempt to widen the limited scope of available manœuvres introduced the only falling-leaf of the contest, and also managed an inverted flick roll. His eight-point roll suffered from lack of power when inverted, but he managed to complete a rolling turn round the airfield, and did a beautifully controlled stall turn.

Biancotto, the winner, this year used a Belgian-registered Czech Zlin Z.226 Trener instead of his former S.R.7B Monitor, presumably to show that the pilot is more important than the aeroplane, since the high-aspect-ratio Zlin seems slightly less manœuvrable than the Stampe monoplane. He seems to have proved his point, although he appeared to some observers to be noticeably less at home in the Zlin. This was not apparent in a prolonged inverted run across the airfield in his individual demonstration, which was done at daisy-cutting height.

In positioning, continuity and accuracy, he was almost flawless, although much more stimulating in the unfettered freedom of Saturday's demonstration. In addition to the now routine selection of inverted and positive *g* manœuvres, including the Zlin's characteristically lazy flick rolls, he made much use of aileron turns while climbing or diving vertically, and also changed the direction of some of his evolutions through 90° halfway through his performance.

Z. Beseda, of Czechoslovakia, who was second, also flew a Zlin Z.226 and gave, in several people's opinion, a much less compact and precise show. Like most of the Czechs, he performed a tail-slide, or "hammer-stall," together with inverted and 1½ flick rolls, and inverted stall turns. His normal and inverted "spectacles" and vertical "eights" were accurate and well positioned.

Chevalier d'Orgeix from France is always a joy to watch in his Stampe, which he puts into 1½ flick rolls to start his show, and gained a well-earned third place. He is especially fond of a two-turn spin after a stall turn, coming out precisely on heading, and also performs a precise eight-point roll and rolling turns.

Last year's winner, V. Krysta, in the single-seat Czech Zlin Z.226 Akrobat, appeared to use less sky and had more rapid continuity than any other contestant. His performance was absolutely brilliant, but presumably the judges detected some microscopic inaccuracies in alignment to account for his fourth-place in the contest. Particularly impressive was his tail-slide, with the airscrew almost stopped, into an outside loop, and the negative *g* which he was obviously applying in large quantities during some of his manœuvres.

Liardon, from Switzerland, in a Bücker Jungmeister, also seemed to have deserved better than his fifth place, the supreme aerobatic qualities of his agile biplane resulting in an effortless performance. His *tour de force* is no fewer than three continuous flick rolls across the airfield, but perhaps his most skilful evolution is a double flick roll, starting and finishing at a vertical bank. He also performed the full range of inverted manœuvres in addition to a two-turn spin from a loop, and did a flick-roll on take-off on Saturday afternoon.

J. Hulka (Zlin Trener) and G. Varette (Stampe) tied for sixth place in the contest, for Czechoslovakia and France, respectively, with the result that the latter country was awarded the team trophy for the first four pilots obtaining the highest aggregate points. Very sportingly, the French offered to base this prize on the points of three, instead of four pilots, to allow the Czechs to compete, and had it been possible to fly the finals, this would have been adopted.—J.E.F.

A Change for the Chipmunk

Above, an action photograph of the Chipmunk 23 shows the excellent swath width when spraying, which is assisted by the wing downwash.

Left, this view of the Chipmunk 23 emphasizes the fixed wing-tip slats and the tall single-seat cockpit. The spray booms are not fitted with nozzles, in this photograph.

FOLLOWING a long and successful career as a basic trainer, which is being pursued in most parts of the World, the de Havilland Chipmunk has now been extensively modified and produced as an agricultural version, designated the Mk. 23. As a joint venture by de Havilland Aircraft and Fison-Airwork, the Chipmunk Mk. 23 combines the excellent handling qualities and performance of the economical trainer design with well-tried spraying and dusting gear developed by one of the biggest specialist companies in this field.

Airframe modifications include replacement of the front cockpit by a large glass-fibre tank for either liquid or solids, with a capacity of 14 cu. ft. and a maximum load of 560 lb. or 88 Imp. gal. The hopper or tank has a 2-sq. ft. quick-opening lid and is designed to take the load of a 112-lb. sack being dumped on it. For loading liquid, a subsidiary quick-release filler cap is incorporated in the hopper lid, with a filter allowing automatic positioning of hose or funnel.

Being located almost on the C.G. of the aircraft, the hopper imposes small trim changes with varying loads and offers maximum safety for the pilot. The seat in the rear cockpit has been raised so that the view is comparable with that obtainable from the front seat, and a deep windscreen and sliding hood provided for full advantage of this position to be obtained. The windscreen is of scratch-resistant flat glass panels, while the canopy has bulged Perspex sides. The cockpit retains most of the basic features and controls of earlier Chipmunks, including a starter-cartridge handle, but the instrument panel has been simplified and now accommodates spray-pressure and hopper-contents gauges, as well as controls for the hopper and windmill brake.

A dump valve enables the full load of chemical to be jettisoned in 15 sec., but this will later be reduced to five. For spraying, a full-span spray bar is fitted slightly below and to the rear of the wing trailing-edge, where maximum downwash effect is obtained, while for dusting, a venturi chute is fitted beneath the fuselage. With the wind-driven pump, these components and their controls were designed by Fison-Airwork. The spray bar produces a swath width of over 90 ft., which reduces spraying time and is said to make the Chipmunk one of the most economical agricultural aircraft.

An important further modification is the addition of fixed outer-wing slats, which reduce the stalling speed to 33 m.p.h. when light, while in the spraying configuration, with half-flap, the stalling speed becomes 38 knots (44 m.p.h.). The wing-root spoilers have been repositioned to provide buffet stall warning. Night- and blind-flying equipment can be provided, and in aircraft with an electrical system a radio with a whip aerial can be carried in the top of the hopper for transit flights. Alternatively, the hopper space may be used for a glass-fibre freight container with a flat floor and a seat for a passenger, making the Chipmunk 23 suitable for light freighting or general utility duties on a quick-change basis.

The standard two 9-gal. wing-root fuel tanks of the Service-type Chipmunks are retained, but a fine-pitch Fairey-Reed metal airscrew is fitted for the optimum low-speed performance. Maximum gross weight is increased by 320 lb. to 2,420 lb., to provide a larger payload. The Chipmunk at the moment is out of production in this country, but modification of the ex-Service machines to Mk. 23 standards promises to be as successful as the wide-scale agricultural adaptation of the Tiger Moth.

PERFORMANCE (at max. weight).—Never-exceed speed, 120 knots; cruising speed (2,250 r.p.m.), 75 knots; take-off distance to 50 ft. (15° flap), 464 yd.; initial climb, about 500 ft./min.; landing distance from 50 ft., 531 yd.

For Vibration Research

FIRST-CLASS laboratory facilities for research into the many problems associated with the isolation of vibration and shock from various forms of electronic and other delicate equipment have been set up at Hersham in Surrey by Cementation (Muffelite), Ltd. In their new laboratory there one finds a comprehensive range of apparatus installed specially for the development testing (and, later, for type approval testing) of the Barrymount vibration isolators made by the British company under licence from Barry Controls Incorporated of Watertown, Massachusetts.

Although these facilities are primarily related to development of current units and equipment they represent an important potential source of knowledge on the subject generally. Indeed, they should prove of immense benefit in the search towards improved reliability of the complex electronic equipment that is being installed in aeroplanes—and missiles—and which is expected to operate satisfactorily under increasingly arduous conditions of vibration and shock loading.

It is interesting, then, to find that the facilities provided in the new laboratory at Hersham will be available to equipment manufacturers and that contract test work will be undertaken. By this means the proper co-operation between those who provide the equipment and those who specialize in vibration absorption will be achieved. The Cementation (Muffelite) Engineering Laboratory is, incidentally, fully approved by the A.R.B.

Among the test equipment available are two mechanical vibration tables for development tests in the 5-55 c.p.s. frequency range; one of these is for horizontal linear vibration and the other vertical linear vibration—100-lb. loads can be given acceleration of up to 10*g*. There is also a 600-lb. moving coil exciter and a smaller 20-lb. unit with a useful frequency range of 5-5000 c.p.s. High- and low-temperature cabinets covering a range of 150° C. down to −75° C. are available for environmental testing. A Barry vertical-drop medium impact shock machine is used for shock-testing equipment weighing up to 400 lb.; a peak acceleration of 75*g* can be achieved with a 0.0065-sec. duration. The laboratory also has a bump test machine capable of testing equipment weighing up to 250 lb. and will give repetitive impact shock loads of 2-3 per sec. and a travel of 0.25-1.25 in.

These fine new facilities were formally opened on July 7 by Mr. W. J. Taylor, C.B.E., Parliamentary Secretary to the Ministry of Supply; he was acting on behalf of the Minister, who had been unable to visit Hersham himself as originally planned. Mr. Taylor commented on the long, prosperous and progressive record of the Cementation (Muffelite) company. He said that the action it had taken in setting up the new laboratory was very much in line with what the Government would like to see—the extension of research facilities in industry over as wide a range as possible. He hoped that the facilities would be shared by other companies—thereby avoiding the duplication of expensive test equipment.

CORRESPONDENCE

Omitted from "Evidence in Camera"

I AM delighted that the letter from Sqn. Ldr. Everest in your issue of July 11 draws attention to the photographic reconnaissance work done by the Extended Reconnaissance Flight of No. 224 Squadron in 1939, and I only wish he had gone into more detail.

The scope of my book "Evidence in Camera—The Story of Photographic Intelligence in World War II" had to be limited, as I was working to meet a deadline. So, as regards the photographic reconnaissance of the 1939 period I purposely concentrated most of my research upon the developments which had the greatest significance for the whole war, i.e. the work of the unit at Heston, which was, of course, the nucleus from which came the successful new photographic reconnaissance units.

Inevitably this meant many heartbreaking omissions in my book, or bare mentions when the facts called for pages or chapters. For instance, I could only allude in passing to the work of Bomber Command's squadrons of photographic reconnaissance Blenheims.

May I take this opportunity of saying how sorry I am that throughout my book, not only at the beginning, much of importance and interest had to be omitted. But if I had tried to include everything the book would have become a record of a different variety, and I would still be writing it.

Cambridge. CONSTANCE BABINGTON SMITH.

Transparent Aircraft

I WAS keenly interested in Mr. C. W. Welch's article "The Contribution of Plastics to Aircraft" (THE AEROPLANE, June 20) of which there are unlimited applications.

Of interest to historical enthusiasts is the mention of a 1914-18 type aircraft which, at 1,600 ft., due to the transparent sheathing, virtually vanished from sight! On behalf of these enthusiasts I would like Mr. Welch to give full details of this aircraft and if possible a photograph of it as well.

Birmingham. M. AUSTIN.

Club Correspondents

I HAVE had the instructive pleasure of reading THE AEROPLANE. During the process of reading over the many instructive facts and information contained therein, I began to accumulate a deep desire to investigate further into the field of the struggles and woes that your flying clubs know. This would be an excellent means of comparison between our countries.

It would be most interesting to correspond with flying enthusiasts from the Mother Country, in this way we would become acquainted with your flying conditions.

15449 Wyandotte, Van Nuys, California. DOROTHY E. A. STEEN, Radioplane Flying Club, Inc. (Acting Vice President).

Cross-winds and Runway Patterns

IN your article on June 13 concerning "London's New Airport"—Gatwick, one small reference to the simplicity of the runway layout compared with London Airport, covers a very important and seldom appreciated factor. You refer to the "changes in aircraft configuration, making cross-wind landings less of an obvious difficulty." I think this small reference is worthy of expansion.

The American aircraft industry started putting aeroplanes on to a "tricycle" undercarriage soon after 1935 yet the importance of the inherent directional stability given by this layout was not appreciated in this country until about 1950. It took 15 years for the "penny to drop" in spite of the fact that technical advice was available from those who had flown American aircraft during the War, as to the high cross-wind acceptable for taking-off and landing these machines, and the important savings which this meant in airport design.

The London Airport design, based on an acceptable cross-wind component of 15 m.p.h. called for three runways to cover the varying wind directions, and resulted in a terminal area enclosed by the runway pattern. This area was obviously too small on the basis of Idlewild experience and needed a very expensive tunnel to provide access.

Not only this, but runways were made 300 ft. wide, presumably to provide for the wanderings of aircraft in landing (later this proved to be such a sea of concrete in low visibility conditions that the pilots could not see the edges and the concrete had to be chiselled up at even greater expense and the runway lights inserted to form the normal 150-ft. width).

If the directional stability of the tricycle undercarriage had been considered and the airlines' own estimate of acceptable cross-wind of about 25 knots had been used, the runway pattern could have been reduced to a V shape, with two runway directions, giving a terminal in the Vee with surface access and room for expansion when the clutter of more buildings and motorcars demanded it. In fact consideration is now being given to closing one runway in order that the terminal may be expanded, thus getting back to the plan which might have been adopted originally.

The cost to the taxpayer, in the lack of appreciation in official circles of the directional stability of the tricycle undercarriage, was not limited to airport expenditure. The aviation industry, possibly on official specifications, continued, after the war, to produce large tail-wheel aircraft.

Woodford Green, Essex. R. H. AYERS, B.Sc., A.R.Ae.S.

[Our correspondent is a little unfair in suggesting that the advantages of the tricycle were "not appreciated in this country until about 1950." The Elizabethan and the Viscount, for instance, have tricycles, yet their basic designs were formulated in 1944 and 1945 respectively.—ED.]

Groundabout

Un-Naval Occasion. The week before last, under "Barge at Large," this column wondered why a Sea Prince didn't have an anchor or boat-hook to prevent its rolling down Yeovil's sloping tarmac and into Normalair's offices. The reason was that it was not a Sea Prince but a civil contract Prince. Also, the pilot was not Naval but civil, he brought in not Admirals but a Naval maintenance crew, and it was not the duty crew, who were busy elsewhere, but the pilot who, wishing to beat approaching bad weather, pulled away the chocks himself. Otherwise, I was dead right. My apologies to the Navy.

*

Benevolent Investment. After that, I am glad to be able to tell you how to help Naval charities *and* profit yourself. Naval Air Displays Publicity, R.N.A.S. Lee-on-Solent, Hampshire, have produced a glossy, 72-page souvenir programme for their Air Day displays. Foreword by Prince Philip, 14 articles, 95 photographs (some in colour), caricatures of 32 Naval aircraft by Wren (this one). Bad weather at the Ford display cut sales. Your 2s. 6d. will help make that good.

*

Disgruntlement Dept. A plague of "Do-It-Yourself" cartoonists has come upon the land. Wherever I go, there they are. Even "Treble-One" Squadron, out at Wattisham, has its Wrenbrandts and Wrenoirs, all drawing madly on crew-room locker doors and producing joke drawings I wish I'd thought of first. Such as the above.

*

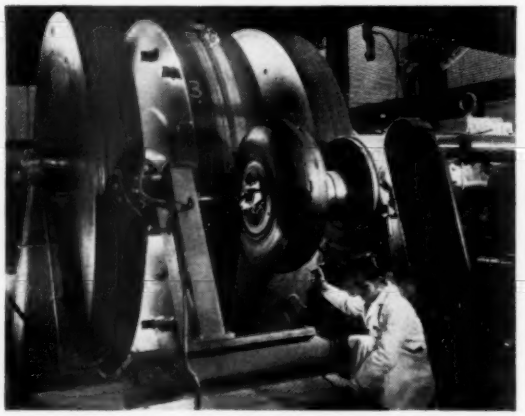
Memorandum from Freddie Meacock, this magazine's technical editor: "Heading from Grumman's *Plane News*—'Grumman's Diversification Move includes Containerization Program.' Should not this be put through the columnization process for inclusionization in our periodicalization of aeronauticalized materialization?" Yes, Freddie.

*

Une Petite Pièce de Tout Droit. The R.A.F. Central Flying School's Type Squadron has a motto which the unyielding College of Heralds is mighty unlikely to pass: It is "PAS D'ELLE YEUX RHONE QUE NOUS." Don't waste time trying to translate but say it in French, aloud.

by Wren

NOTES AND EVENTS



TYRE TEMPERATURE.—This photograph, showing the temperature of an aero-tyre being taken after a run on a high-speed test machine, was taken by Mr. Tom Grover, staff photographer of the Dunlop Rubber Co., Ltd. It has been selected by the Institute of British Photographers for showing at the annual conference of the Photographic Society of America (Industrial Section) in Chicago this month.

TV AT BARTON.—A B.B.C. television programme, "A Breath of Fresh Air," will be broadcast on July 20 from the Lancashire Aero Club at Barton aerodrome, Manchester, from 15.05 to 15.30 hrs. Raymond Baxter will introduce the programme.

BAKELITE INFORMATION.—A new set of advance information sheets has been issued by Bakelite, Ltd., of 12 Grosvenor Gardens, London, S.W.1, giving the first published information on a number of the company's polyester resins, including details of the self-extinguishing grades which are now being marketed.

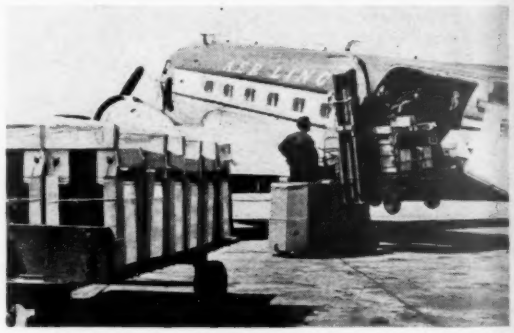
PHILIDAS BROCHURE.—Whitehouse Industries, Ltd., of Ferrybridge, Knottingley, Yorks, has issued a revised catalogue dealing with Philidas self-locking nuts. These nuts, the company claims, can be used wherever vibration problems are met, and modern production methods have shown that they effectively replace spring and tab washers, split pins and second lock nuts.

I.P.E. REPORT.—Recently published by the Inst. of Prod. Engineers, 10 Chesterfield Street, London, W.1, is a 48-pp. booklet entitled "Quality—Its Creation and Control." It costs 10s., plus 1s. for postage and packing. The president of the I.P.E., The Rt. Hon. The Earl of Halsbury, F.R.I.C., F.Inst.P., M.I.Prod.E., is to remain in that office for a further year. Mr. H. W. Bowen, O.B.E., M.I.Mech.E., M.I.Prod.E., has been elected chairman of council for the coming year.

Aviation Calendar

July 19.—R.N.A.S. **Eglinton** "At Home."
July 19.—R.N.A.S. **Culdrose** "At Home."
July 19.—"At Home" organized by the **Lasham Gliding Centre.**
July 19.—Air Display organized by the Fair Oaks Aero Club, at **Fair Oaks Aerodrome,** Surrey.
July 19-20.—Caen Rally organized by the Calvados Aero Club, **France.**
July 26.—R.N.A.S. **Lossiemouth** "At Home."
July 26-27.—Tour of the Dolomites arranged by the Trente and Bolzano Aero Clubs, **Italy.**
July 26 - August 4.—National Gliding Week organized by the B.G.A.
August 1-16.—World Parachute Championships organized by the Czech Aero Club at **Bratislava,** Czechoslovakia.
August 2.—R.N.A.S. **Brawdy** "At Home."
August 2-4.—Rally organized by the Plymouth Aero Club, at **Plymouth Airport.**
August 10.—Tea Patrol organized by Elstree Flying Club at **Elstree Aerodrome.** (15.45—16.15 hrs.)
August 10.—Visit of NATO air cadets to Surrey Flying Club, **Croydon.**
August 16-17.—Second Wines-of-Alsace rally organized by the Aéro-Club Centre, **Alsace,** France.
August 18.—International Military Aeronautical Pentathlon, at **Ostend,** Belgium.
August 31.—Oxford Aeroplane Club "At Home," at **Kidlington Airport,** Oxford.
September 1-7.—S.B.A.C. Display and Exhibition, at **Farnborough.**
September 8 - 13.—First International Congress of the Aeronautical Sciences, **Madrid.**

FREIGHT BY AIR.—A Leeds company is now sending gas cookers to Ireland on the Manchester - Dublin freight service of Aer Lingus. Packing is simple and damage is negligible. Deliveries can be made within 24 hr. of an order being received.



PULLIN MOTOR.—A new addition has been added to the range of small low-voltage permanent-magnet motors manufactured by R. B. Pullin and Co., Ltd., of Brentford, Middlesex. Available at a standard voltage of 28 V. DC, the new motor, international size 18, can be supplied governed or ungoverned. It is also available as a DC tachometer generator with a rated output of 16.7 V. per 1,000 r.p.m. and maximum linearity error at 5,000 r.p.m. of 0.1 per sec.

ESSO REFINERY.—The Esso Petroleum Co., Ltd., has announced that it is to build a refinery and marine installation at its site near Milford Haven. Work is to start immediately. Costing approximately £18 million, its principal products will be petrols, jet fuels and other fuels.

Company Notices

NEW COMPANIES

Association of Light Alloy Refiners and Smelters, Ltd. (607,045).—Reg. June 26, as a co. limited by guarantee, without sh. cap. Original number of members is 25 each being liable for £5 in the event of winding up. Subscribers: Norton Aluminium Products, Ltd., Norton Canes, Cannock, Staffs; T. J. Priestman, Ltd., Cupro Foundry, Leopold St., Birmingham, 12; Wigley Aluminium, Ltd., Horsley Woodhouse, Derbyshire; John Cox and Sons (Metals), Ltd., Birmingham, 12; John E. Moore, Ltd., Yeadon, Yorks; B. K. L. Alloys, Ltd., Birmingham; John Dale, Ltd., St. Albans; Eyre Smelting Co., Ltd., Merton Abbey, London, S.W.19; J. Frankel (Aluminium), Ltd., Walsall; International Alloys, Ltd., Aylesbury, Bucks; Wolverhampton Metal Co., Ltd., Wednesfield; Atkins "Metals," Ltd., Birmingham, and Enfield Rolling Mills (Aluminium), Ltd., Brimsdown, Enfield. First members of Council are Bennett Endlar, Rudolf Hahn, Oswald G. Halliwell, Richard Hopkins, Julius Jakobi and Ernest W. Nicholls. Solrs: Clifford-Turner and Co., 11 Old Jewry, London, E.C.2.

Swift Travel Club, Ltd. (607,225).—Private co. Reg. June 30. Cap. £100 in £1 shs. Objects: To carry on the business of a club in connection with aviation, etc. Subscribers: Charles V. Ody, 32 Surrey Rd., Bournemouth, radio officer (air), director, Swift Travel Services, Ltd., 10 shs.; Robert L. Critchley, Canford Chambers, St. Peters Rd., Bournemouth, solicitor, one sh.; Charles V. Ody is permanent managing director. Sec.: Shirley F. A. Critchley. Solrs.: Critchley and Carpenter, Bournemouth. Reg. off.: Canford Chambers, St. Peters Rd., Bournemouth.

INCREASE OF CAPITAL

Aero Research, Ltd. (286,630). Huxton Rd., Duxford, Cambridge.—Increased by £500,000 in £462,000 "A" and 38,000 "B" shs. of £1 each, beyond reg. cap. of £250,000.

New Patents

APPLICATION ACCEPTED

800,429.—Von Zborowski, H.P.G.A.R.—"Aircraft provided with spoilers."—Aug. 4, 1955. (Aug. 6, 1954.)

Application open to public inspection on Aug. 27, 1958; opposition period expires on Nov. 27, 1958.

BIRTHS

Contaris.—On July 7, at R.A.F. Hospital, Halton, to Sophie (*née* Voutsas), wife of Sqn. Ldr. A. Contaris—a daughter.

Fitch.—On July 4, at Tonbridge Nursing Home, to Dilys, wife of Gp. Capt. J. McQ. Fitch—a son.

Gibbs.—On July 5, at R.A.F. Hospital, Ely, to Pauline, wife of Sqn. Ldr. P. Gibbs—a daughter.

Gibson.—On June 30, at Bath to Brenda (*née* Woodall), wife of Flt. Lt. B. M. Gibson—a son.

Henly.—On July 3, at York, to Doreen (*née* Allen), wife of Flt. Lt. J. Henly—a son.

Hives.—On July 4, at Sleaford, to Shirley (*née* Walker), wife of Flt. Lt. the Hon. D. B. Hives—a daughter.

Hornsby.—On July 2, at Southsea, to Joy, wife of the Rev. E. Hornsby, R.A.F.—a daughter.

Lilleystone.—On July 5, at Norfolk and Norwich Hospital, to Joan, wife of Sqn. Ldr. J. Lilleystone—a daughter.

Pigott.—On June 30, at Blackpool, to Iris, wife of the Rev. J. D. Pigott, R.A.F.—a son.

Saunders.—On July 6, at Sleaford, to Barbara Jane (*née* Duminy), wife of Sqn. Ldr. R. T. Saunders—a daughter.

Taplin.—On July 1, at Swindon, to Shirley (*née* Butler), wife of Sqn. Ldr. F. M. N. Taplin—a son.

Thompson.—On July 6, at London, to Sophia (*née* Little), wife of Flt. Lt. P. J. Thompson—a daughter.

Watson.—On July 1, at B.M.H., Nicosia, to Rosalie (*née* Millar), wife of Sqn. Ldr. C. W. Watson—a son.